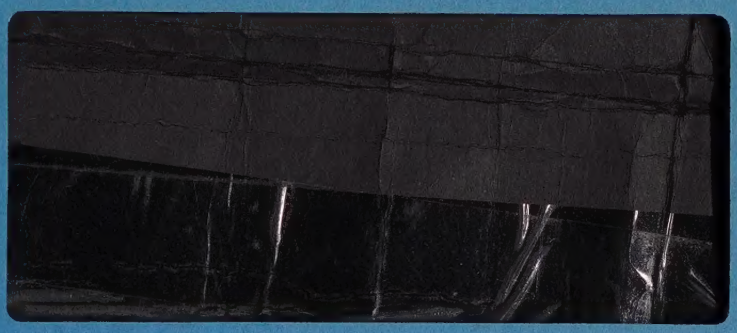

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INSTRUCTION MANUAL

High-Resolution Spectrum Analyzer

Model SS-500

75 CPS to 600 KC

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TABLE OF CONTENTS

Paragraph	Title	Page
	SECTION I - INTRODUCTION	
1-1	Scope of Manual	1
1-3	Purpose of Equipment	1
1-5	General Description	1
1-7	Equipment Supplied	1-2
1-9	Technical Characteristics	3
1-11	Electron Tube, Indicator Lamp, Diode, and Fuse Complement	3
	SECTION II - INSTALLATION & OPERATION	
2-1	Unpacking and Preliminary Inspection	6
2-3	Installation	6
2-6	Controls, Indicators, and Connectors	6-8
2-8	Operation	9
2-9	Preliminary Operating Procedure	9
2-10	Presentation Adjustment	10
2-12	Balance Adjustment	11
2-14	Scale Multiplier & Attenuation Controls Adjust	11
2-16	Spectral Display Measurements	12
2-18	Voltage Measurements	13
2-20	Noise Measurements	14
	SECTION III - THEORY OF OPERATION	
3-1	Introduction	15
3-3	Simplified Block Diagram Analysis	15
3-6	Detailed Circuit Analysis	15
3-8	Attenuator and Overload Protection Circuit	15
3-9	Input Filter V103	16
3-10	Phase Inverter V104	16
3-14	Balanced Mixers V105 and V106	16
3-17	Cathode Follower V107	16
3-19	Crystal Driven Filter Amplifiers V201 & V202	17
3-22	I-F Amplifiers V203, V204, and V205	17
3-26	Detector V206	18
3-29	Vertical Deflection Amplifier V305	18
3-31	Local Oscillator V401, V402 and V403	18
3-35	Blocking Oscillator V301	19
3-37	Sweep Oscillator V302	19
3-41	Horizontal Deflection Amplifier V304	20
3-44	Marker Oscillator V306	20
3-45	Cathode Ray Tube Power Supply	20
3-47	Power Supplies	20
3-48	Cathode Ray Tube Power Supply	20

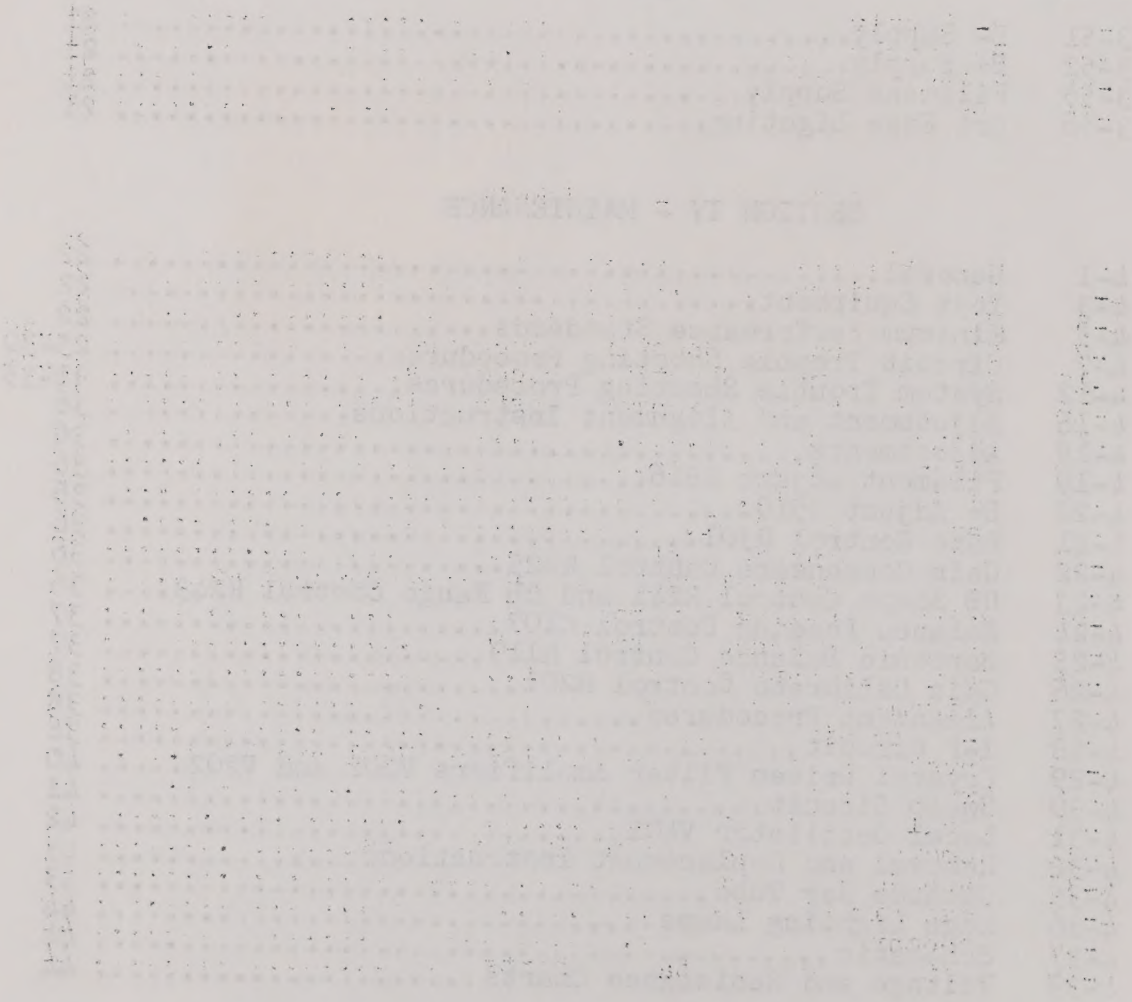
TABLE OF CONTENTS (CONT'D)

Paragraph	Title	Page
3-51	B- Supply	21
3-52	B+ Supply	21
3-55	Filament Supply	21
3-56	Crt Edge Lighting	21

SECTION IV - MAINTENANCE

4-1	General	22
4-3	Test Equipment	22
4-5	Minimum Performance Standards	22
4-7	Circuit Trouble Shooting Procedures	25-30
4-12	System Trouble Shooting Procedures	31-35
4-16	Adjustment and Alignment Instructions	36
4-18	Adjustments	36
4-19	Filament Adjust R516	36
4-20	B+ Adjust R510	36
4-21	Rate Control R301	36
4-22	Gain Compensate Control R225	36
4-23	DB Shape Control R241 and DB Range Control R243	36
4-24	Balance Phasing Control C107	37
4-25	Harmonic Balance Control R119	37
4-26	Gain Calibrate Control R201	38
4-27	Alignment Procedures	38
4-28	I-F Circuit	38
4-29	Crystal Driven Filter Amplifiers V201 and V202	40
4-30	Sweep Circuit	41
4-31	Local Oscillator V401	42
4-32	Removal and Replacement Instructions	43
4-35	Cathode Ray Tube	43
4-36	Edge Lighting Lamps	44
4-37	Schematic	44
4-39	Voltage and Resistance Charts	44

SECTION V - PARTS LIST



SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL

1-2. This manual contains instructions for the installation, operation and maintenance of the Probescope Spectrum Analyzer, Model SS-500. The Model SS-500 is designed and manufactured by Probescope Company, Inc., Syosset, Long Island, New York.

1-3. PURPOSE OF EQUIPMENT

1-4. The Spectrum Analyzer, Model SS-500 is a precision instrument for presenting the spectral diplay of signal energy in the frequency range from 75 cps to 600 kc. The spectral display appears on the screen of a long-persistence cathode ray tube with the frequency of the applied signal being displayed on the horizontal asis, while the amplitude of the signal is displayed on the vertical axis. Some of the specific uses of the Model SS-500 are:

a. Harmonic and distortion study of amplifiers, modulators and oscillators.
b. Noise and vibration analysis.
c. Medical research such as heartbeat and brain wave analysis.
d. Acoustic measurements.
e. Filter and transmission line checks.
f. Assembly line checking and maintenance of equipment.
g. Power supply ripple and harmonic investigations.
h. Underwater sound analysis.
i. Single Sideband Analysis.

1-5. GENERAL DESCRIPTION.

1-6. The Probescope Model SS-500 is a versatile precision instrument that combines high accuracy, simplicity of operation, ease of maintenance, and portability. The Model SS-500 is a highly sensitive superheterodyne receiver, whose voltage output can be linearly or logarithmically displayed on a calibrated cathode ray tube. The equipmetn consists essentially of a calibrated input attenuator, a low pass filter, a phase inverter, a balanced mixer, a swept local oscillator, crystal filter, i-f amplifiers, a detector, a blocking oscillator (sweep generator), and horizontal and vertical deflection amplifiers for the cathode ray tube display. The Model SS-500 is furnished in a cabinet for bench or cart use, or can be removed from its cabinet for standard rack mounting.

1-7. EQUIPMENT SUPPLIED.

1-8. Table 1-1 lists the equipment which comprise the Model SS-500.

Component	Model or Part No.	Over-all Dimensions (in.)	Weight (lbs.)
Spectrum Analyzer	SS-500	15½H. x 22W. x 18D.	85 lbs.
Line Voltage Regulator		7½H. x 4½W. x 8-3/4D.	18 lbs.
Alignment			
Spare Fuses			
Accessory Plug			
Handbook			

Table 1-1. Equipment supplied.

1-9. TECHNICAL CHARACTERISTICS

1-10. The technical characteristics of the Model SS-500 are listed below.

Frequency Range.....75 cps to 600 kc

Sweep Width (Deviation).....2 kc to 200 kc

Sweep Rate.....3 per second

Sweep Width Accuracy..... ±5% of total sweep width to 500 kc; at 600 kc ±10%

Resolution(automatically optimum).....150 cps to 2 kc*

Voltage Range(full scale deflection)...250 microvolts to 250 volts**RMS

Voltage Scale.....RMS and 40 DB Log

Dynamic Range.....60 db

Voltage Accuracy.....±10% linear scale (rms) ±1 db log scale

Input Impedance.....50,000 ohms

*See figure 1-2 for resolution versus sweep width chart

**Overload protection circuit provided.

External Marker Requirements.....500 millivolts rms min.

Internal Marker.....100 kc (crystal oscillator)

Hum Supression.....60 db

Frequency Stability:
- Short Term.....200 cycles
- Long Term.....5 kc/day

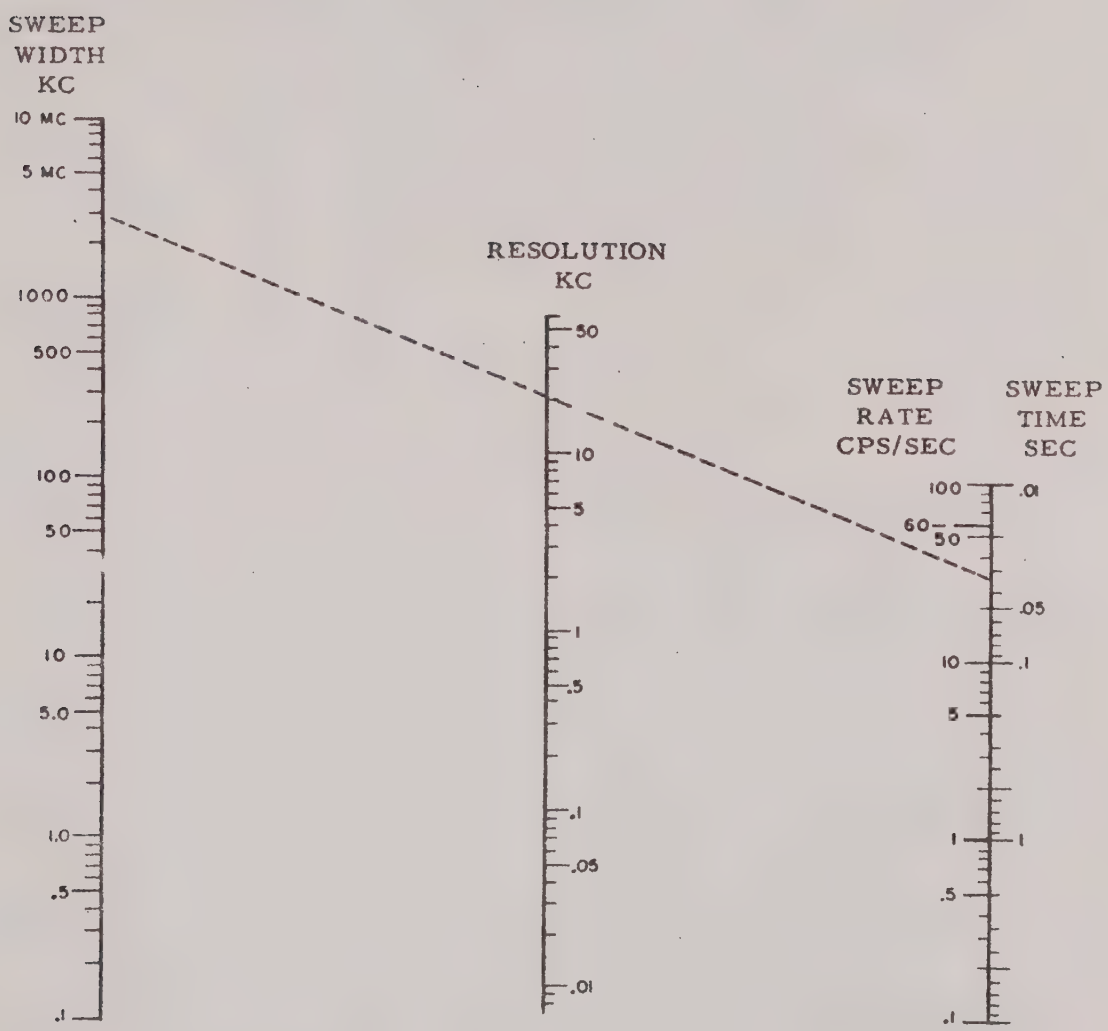
Spectral Display.....Signal amplitude on vertical axis (linear or log), versus frequency on horizontal axis.

Cathode Ray Tube.....5ADP7 (long-persistence) with edge lighting and camera mount bezel.

Signal Outputs:
- Vertical.....0.5 volts negative pulse minimum
- Horizontal.....0.5 volts positive sawtooth minimum
- Sync.....5 volts positive pulse minimum
- Local Oscillator.....1.5 to 2 mc signal,0.4 volts

1-11. ELECTRON TUBE, INDICATOR LAMP, DIODE, AND FUSE COMPLEMENTS

1-12. Tables 1-3 through 1-5 list the electron tube and indicator lamp, diode and fuse complements respectively.



NOTE

Portions of this nomograph which are usable for the analyzer covered by this Instruction Manual are listed under maximum sweep width, sweep rates and resolution in section I – ELECTRICAL CHARACTERISTICS.

Figure I–2. Resolution Nomograph.

Reference Symbol Designation	Type	Function
V101	NE 2 Neon Bulb	Overload Protection
V103	12AY7	Input Filter
V104	5879	Phase Inverter
V105, V106	6BH6	Balanced Mixers
V107	12AU6	Cathode Follower
V201, V202	6AB4	Crystal Filter Amplifiers
V203,V204,V205	12AU6	I-f Amplifiers
V206	6C4	Detector
V301	12AU7	A: Blocking Oscillator B: Cathode Follower
V302	6072	A: Swept Oscillator Control B: Swept Oscillator Driver
V303	85A2/5651	Voltage Regulator
V304	12AX7	Horizontal Deflection Amplifier
V305	12AX7	Vertical Deflection Amplifier
V306	6AB4	Marker Oscillator
V401	6201	A: Miller Reactance Tube B: Oscillator
V402	12AT7	A: Oscillator Amplifier B: Cathode Follower
V403	6AB4	Cathode Follower
V505	6AS7G	Voltage Regulator Control
V506	12AU6	Voltage Control DC Amplifier
V507	85A2/5651	Voltage Regulator
V508	OB2	Voltage Regulator
V509 thru V514	NE 2 Neon Bulb	Defective Filament Indicators
V515 thru V520	No. 47 Panel Lamps	CRT Edge Lighting
V521	5ADP7	Cathode Ray Tube

Table 1-3. Electron Tube & Indicator Lamp Complement

Reference Symbol Designation	Type	Function
CR502, CR503	Syntron SS45PH	High Voltage Rectifiers
CR504 thru CR516	Semicon S19 or SR 3011	Rectifiers

Table 1-4. Diode Complement

Reference Symbol Designation	Type	Rating
F501, F502	3AG	2A, 250V

Table 1-5. Fuse Complement

SECTION II

INSTALLATION AND OPERATION

2-1. UNPACKING AND PRELIMINARY INSPECTION

2-2. Unpack equipment from its carrying case, observing normal precautions for a precision instrument. Before operating the Model SS-500, inspect for possible damage during shipment. Check that the equipment is complete as listed in table 1-1 or against the packing slip. After the equipment has been checked for completeness, inspect it as follows:

a. Examine handles and latches for tightness.
b. Operate all front panel controls,which should turn freely be tight on their shafts, and lack of binding.
c. All tubes, crystals, and other plug-in parts are well seated in their sockets.

2-3. INSTALLATION

2-4. The equipment can be placed in any suitable working area where normal lighting and ventilation are present. The line voltage regulator supplied must be used at all times with the Model SS-500 in order to have a stable supply of power to the equipmetn. The line voltage regulator should be placed as far as possible from the analyzer to minimize hum pickup.

2-5. The Model SS-500 is furnished mounted in a cabinet for bench or cart use. It can be removed from its cabinet for standard rack mounting. Figures 2-1 and 2-2 are outline drawings of the Spectrum Analyzer and Line Voltage Regulator, to assist the operator in planning the equipments' installation.

2-6. CONTROLS, INDICATOR, AND CONNECTIONS

2-7. The operating controls, indicator, and connectors located on the front panel of the equipment are listed in table 2-1, and shown in figure 2-3. It is important to know the function of each control before operating the equipment.

Figure 2-3 Index No.	Front Panel Designation	Function
1	Cathode Ray Tube	Provides input signal display; frequency on horizontal axis, amplitude (lin. or log) on vertical axis.
2	DEVIATION KC/S	This control varies the sweep width (between 2-200 kc) of the portion of the spectrum to be analyzed. It is automatically tracked for optimum resolution at any deviation setting.

Table 2-1. Operating Controls, Indicator and Connectors
(cont'd. next page)

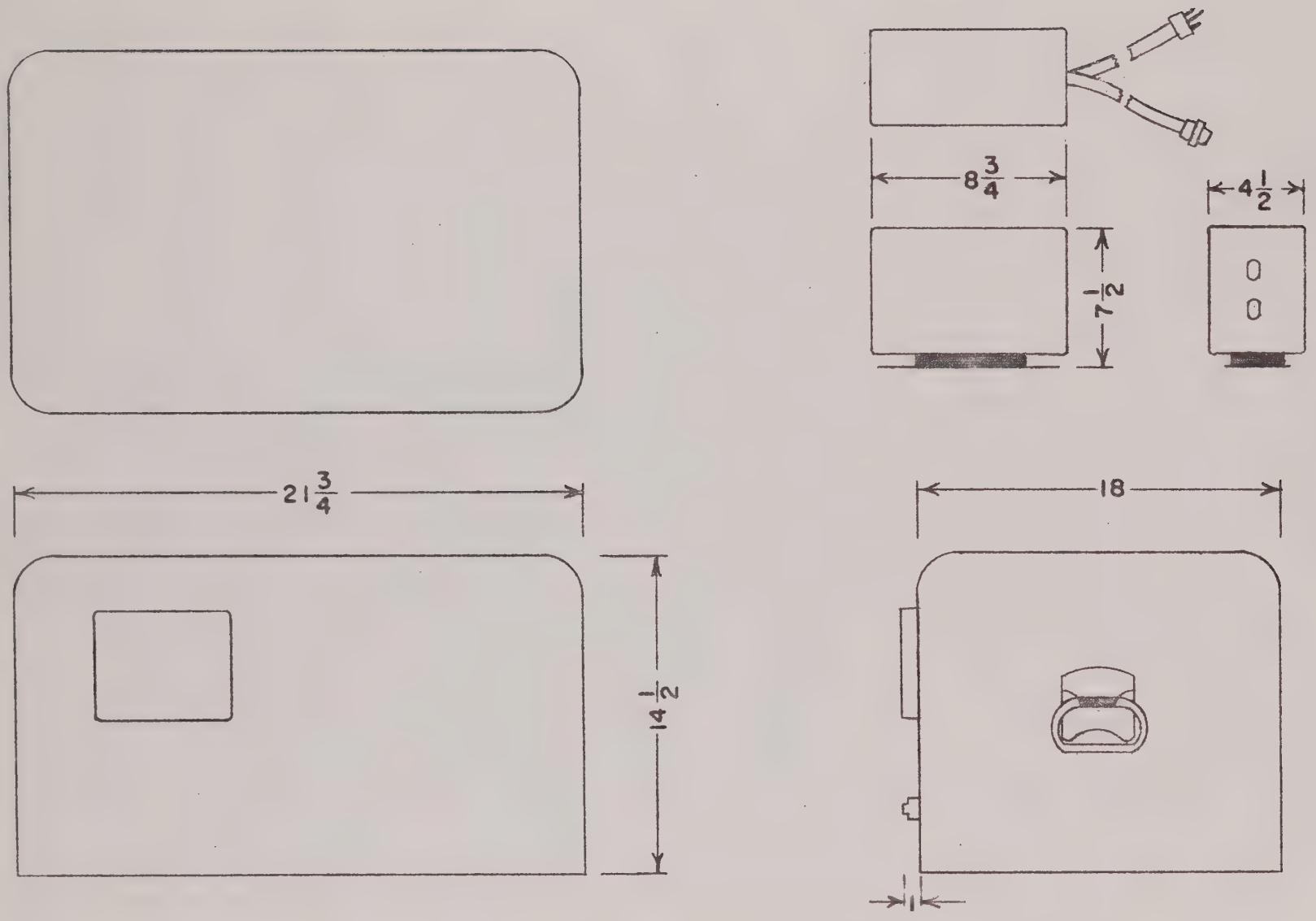


FIGURE 2-1 SPECTRUM ANALYZER MODEL SS-500 AND LINE REGULATER OUTLINE DRAWING

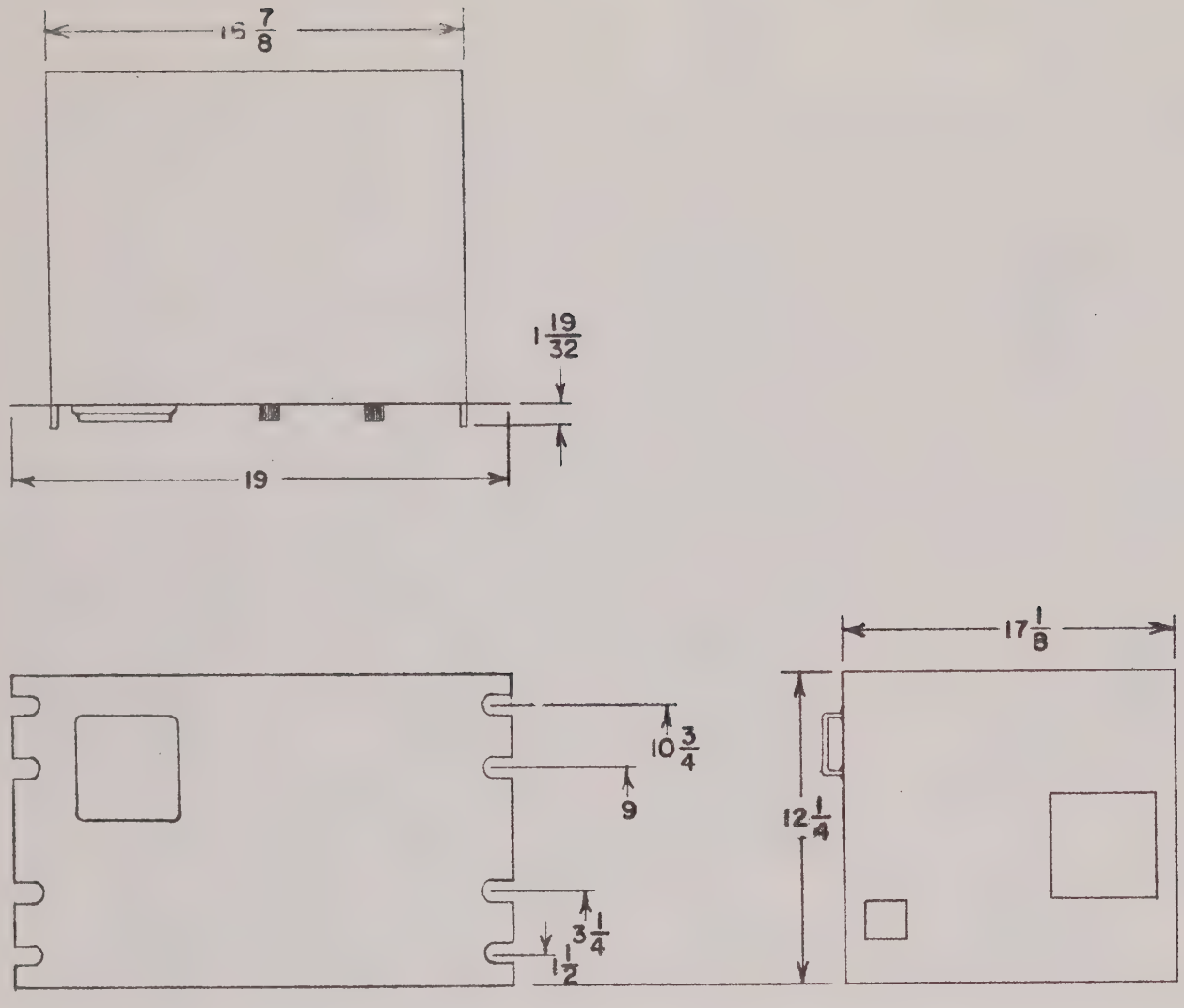


FIGURE 2-2 SPECTRUM ANALYSER MODEL SS-500 RACK MOUNT DRAWING

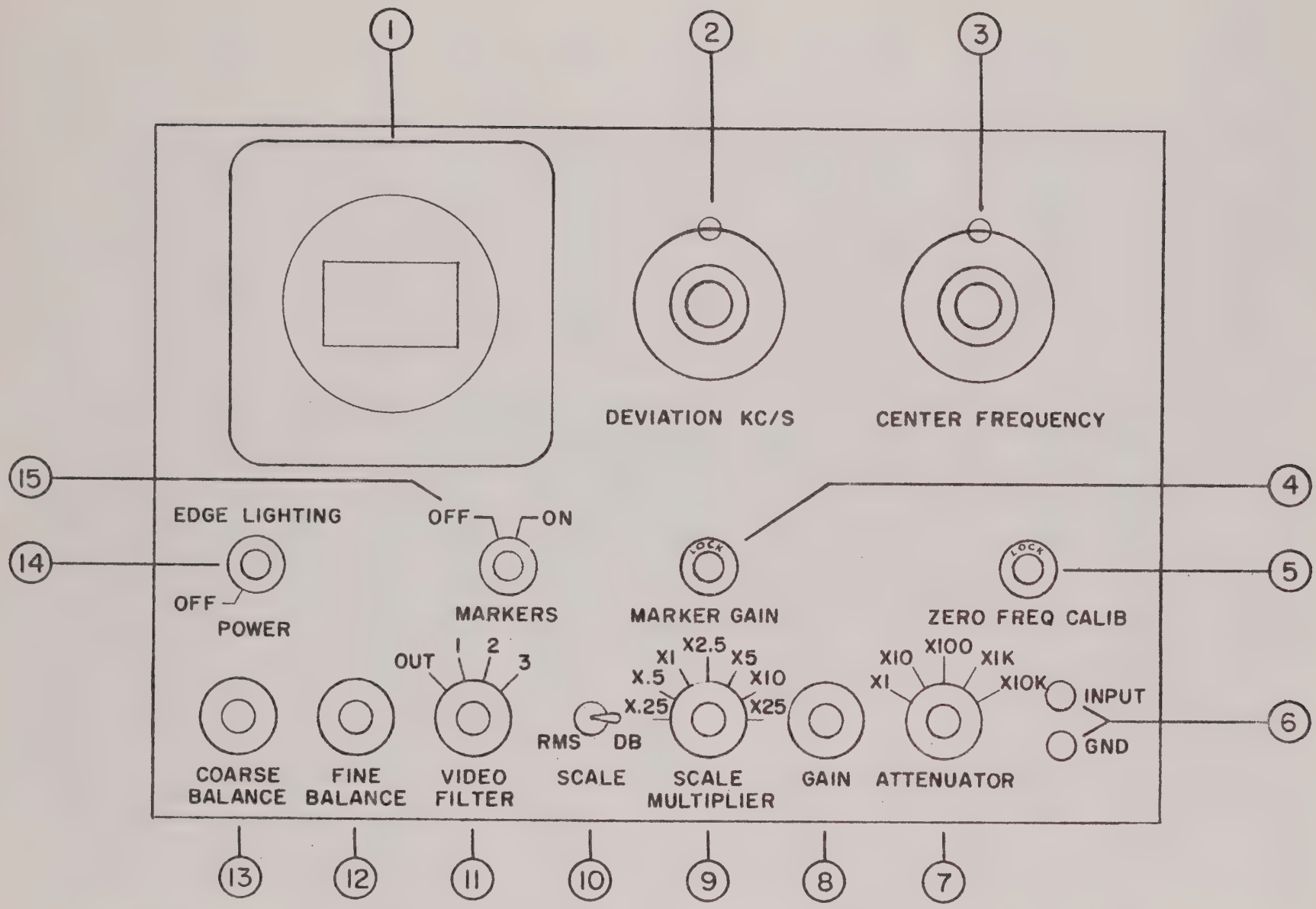


FIGURE 2-3 OPERATING CONTROLS, INDICATORS AND CONNECTORS

Figure 2-3 Index No.	Front Panel Designation	Function
3	CENTER FREQUENCY	This control is individually calibrated for each Model SS-500 at 10 kc intervals from 0 to 500 kc. It indicates the frequency at the center of the screen.
4.	MARKER GAIN	This control adjust the 100 Kc marker level.
5	ZERO FREQ. CALIB.	This control is used to adjust the horizontal position of the zero-frequency pip.
6	INPUT/GND	Input signals to be analyzed are applied to these terminals.
7	ATTENUATOR	A calibrated voltage divider for reducing the level of the input signal. This control is used to vary the amplitude of signal on the screen.
8	GAIN	Permits adjustment of the height of the vertical display on the crt screen. Calibrated sensitivity holds only when this control is set fully clockwise.
9	SCALE MULTIPLIER	This calibrated seven-position switch further attenuates the incoming signal.
10	SCALE	This switch permits choice of vertical screen calibration: RMS - Horizontal lines on screen indicate linear rms amplitude as calibrated along left edge. DB - Dots appearing along right edge indicate 5 db increments from 20 to -20 db as calibrated.
11	VIDEO FILTER	The Video Filter control is used to eliminate beat interference between two adjacent signals. Proper choice of filter position is indicated by no change in amplitude. Position 3 is used in noise and vibration analysis. It provides a smoothing of the noise appearing on the screen.

Table 2-1. Operating Control, Indicator and Connectors
(Sheet 2 of 3)

Figure 2-3 Index No.	Front Panel Designation	Function
12, 13	FINE BALANCE COARSE BALANCE	These controls are used to suppress the zero-frequency signal on the screen.
14	POWER	This control energizes the equipment and varies the crt edge lighting.
15	MARKERS	This switch (in the ON position) applies an internally generated crystal-controlled 100 kc marker.

Table 2-3. Operating Control, Indicator and Connectors
(Sheet 3 of 3)

2-8. OPERATION

2-9. PRELIMINARY OPERATING PROCEDURE. The procedure given below is to be followed prior to making measurements with the Model SS-500.

(1) Connect a niminal 115 volts ac, 60 cps, single phase power to the equipment thru the line voltage regulator.

(2) Set the front panel controls to:

CENTER FREQUENCY--0
DEVIATION KC/S--100
SCALE MULTIPLIER--X25
SCALE--DB

(3) Turn the POWER control clockwise until the crt screen is illuminated to desired brightness.

(4) Within a few seconds a dot will appear and begin moving across the screen. This dot is the baseline trace.

(5) A zero-frequency pip will soon appear on the screen. Allow at least 30 minutes for the pip drift to stabilize.

NOTE

If the zero-frequency pip is not visible on the screen, reduce the attenuation setting of the SCALE MULTIPLIER control. If the pip is still not visible or is extremely small, set SCALE switch to RMS.

(6) If the zero-frequency pip is not directly at the center graticule of the screen, unlock and adjust the ZERO FREQ. CALIB. control to position the pip. Relock this control.

(7) Set CENTER FREQUENCY control to 100.

(8) Set MARKERS switch to ON.

(9) A marker pip will appear at the center graticule of the screen.

(10) The equipment is now ready for use.

NOTE

The signal presentation adjustment controls have been factory set for optimum viewing. If it is required to adjust the signal presentation, refer to paragraph 2-10 for the procedure.

2-10. PRESENTATION ADJUSTMENT

2-11. The controls listed in table 2-2 have been factory set for optimum viewing of the signal display. If it is required to adjust the signal display for focus, intensity, astigmatism, or line size refer to table 2-2 and adjust the appropriate control as required.

CONTROL	LOCATION	FUNCTION
Focus (R520)	Rear apron	This control adjusts the sharpness of the trace.
Intensity (R517)	Rear apron	This control adjusts the brilliance of the trace. (NOTE: Do not use this control to intensify the trace because of excessive external lighting conditions).
Astigmatism (R522)	Rear apron	This control is used to provide uniform focus throughout the trace.
Vert. Pos. (R337)	On chassis	This control is used to adjust the vertical position of trace. Clockwise rotation raises the trace.
Horiz. Pos. (R327)	On chassis	This control is used to adjust the horizontal position of the trace. Clockwise rotation shifts the trace to the right.
Line Size (R322)	On chassis	This control varies the size of the spot excursion. Correct line size is 3-3/4 inches. When varying line size, adjustment of horizontal positioning may be necessary.

Table 2-2. Presentation Controls.

2-12. BALANCE ADJUSTMENT

2-13. With the CENTER FREQUENCY control set between 0 and 100 (100 kc) and the DEVIATION KC/S control set to maximum, a vertical zero-frequency pip is visible on the screen. If it is desired to suppress this pip because it may interfere with an applied signal display or when making low-frequency measurements, the following adjustments of the COARSE and FINE BALANCE controls are required.

(1) Set the front panel controls to:

SCALE MULTIPLIER--X25
SCALE--DB
DEVIATION KC/S--Maximum

(2) If the zero-frequency pip is not visible on the screen, reduce the attenuation setting of the SCALE MULTIPLIER control. If the pip is still not visible or is too small to observe reduction when rotating the COARSE and FINE BALANCE controls, set the SCALE switch to RMS.

(3) Slowly rotate the COARSE BALANCE control for maximum suppression of the zero-frequency pip.

(4) Slowly rotate the FINE BALANCE control in very small increments for further suppression of the pip. Adjustment of this control is very critical.

(5) Several back-and-forth adjustments of these two controls may be necessary until the balance is completed.

(6) If trouble is incurred in reducing the zero-frequency pip refer to paragraph 4-24.

2-14. SCALE MULTIPLIER AND ATTENUATION CONTROLS ADJUSTMENT

2-15. Five nominal input voltage ranges are provided to attenuate the incoming signal to the Model SS-500. Each of these ranges is divided into seven scale ranges by the SCALE MULTIPLIER control. Table 2-3 lists the rms voltage required for full scale signal deflection with three combinations of the SCALE MULTIPLIER and ATTENUATOR controls. Absolute voltage measurements of any incoming signal (up to 250 volts rms) can be read directly from the screen. Calibration only holds when the GAIN control is set fully clockwise.

ATTENUATOR / SCALE MULTIPLIER	X1	X10	X100	X1K	X10K
X0.25	.25 mv	2.5 mv	.025 v	.25 v	2.5 v
X2.5	2.5 mv	.025 v	.25 v	2.5 v	25 v
X25*	.025 v	.25 v	2.5 v	25 v	250 v

*RMS voltage of applied signal should never exceed amount indicated in this row.

Table 2-3. RMS Voltage Required for Full-Scale Deflection.

2-16. SPECTRAL DISPLAY MEASUREMENTS

2-17. To observe the spectral characteristics of signals for: Frequency component identification; harmonic investigations; modulation characteristics; power supply filtering; etc., the following general techniques should be used:

(1) Follow the procedure given in paragraph 2-9, for starting equipment.

(2) If the input voltage level of the signal to be analyzed is unknown, set the ATTENUATOR Control to X1OK and the SCALE MULTIPLIER control to X25. If the input voltage level is known, refer to paragraph 2-16 for appropriate settings of the ATTENUATOR and SCALE MULTIPLIER controls.

(3) Connect the signal to be analyzed to the front panel INPUT/GND receptacles.

NOTE

Providing that the voltages indicated in table 2-5 are not exceeded, it is completely permissable to have crt screen deflection greater than full scale, therby permitting measurements of low-level sideband signals and amplitude ratios as great as 60 db.

(4) Set the CENTER FREQUENCY control to the frequency of the applied signal and the DEVIATION KC/S control to maximum. If the frequency of the applied signal is unknown, rotate the CENTER FREQUENCY control until the signal is displayed on the crt. Reduction of the attenuation settings of the ATTENUATOR and SCALE MULTIPLIER controls may be required if the signal is not visible or is too small in amplitude.

(5) Set the DEVIATION KC/S control for desired spectrum width.

(6) When performing frequency measurements, set the SCALE switch to RMS to obtain a better definition of the signal pip(s). Direct frequency measurements can be performed by either of two methods:

a. Rotate the CENTER FREQUENCY control until the signal of interest is directly over the center graticule of the crt screen. The frequency of the signal can be directly read from the CENTER FREQUENCY control markings.

b. For frequency identification of complex signal spectrums, the setting of the DEVIATION KC/S control, and relating the spectrum width to the horizontal reference base line percentage graduations, the frequency of the signal of the signal of interest can be read.

EXAMPLE: Assume that the CENTER FREQUENCY control is set to 10 (10,000cps) and the DEVIATION KC/S control is set to 1 (1,000cps). This arrangement permits signals from 9,000 to 11,000cps to be displayed on the screen. The bottom graduations are marked in percentage of deviation from the center of the screen. Therefore, in this illustration, each 20% marking indicates 200 cps either below or above 10,000 cps. If a signal is observed directly at the -40% marking this signal is at a frequency of:

10,000 cps - 400 cps = 9,600 cps

(7) A 100-kc crystal-controlled marker signal is available when the MARKERS switch is in the ON position. These marker pips can be used to determine frequency of applied signals and for checking dial accuracy.

2-18. VOLTAGE MEASUREMENTS

2-19. Absolute voltage measurements of signal(s) or the voltage difference between adjacent signals may be measured in the following manner:

(1) Follow the procedure given in paragraph 2-9.

(2) If the input voltage level of the signal to be measured is unknown, set the ATTENUATOR control to X10K and the SCALE MULTIPLIER control to X25. If the input voltage level is approximately known, refer to paragraph 2-16 for appropriate settings of the ATTENUATOR and SCALE MULTIPLIER controls.

(3) Connect the signal to be measured to the INPUT/GND receptacles.

(4) Set the CENTER FREQUENCY control to the frequency of the applied signal. If the frequency of the applied signal is unknown, rotate the CENTER FREQUENCY control until the signal is displayed on the crt. Reduction of the attenuation settings of the ATTENUATOR and SCALE MULTIPLIER controls may be required if the signal is not visible or is too small in amplitude. Set the DEVIATION KC/S control for desired spectrum width.

(5) To observe signals of comparable amplitude, the SCALE switch should be set to RMS. The RMS scale of the crt screen is calibrated into ten divisions. Horizontal line on the crt screen indicate linear rms amplitude. When simultaneous examination of signals of side divergence (greater than 20 db but less than 40 db) of amplitude is desired, the DB setting of the SCALE switch permits both signals to be seen. In this position, the calibrated range is from +20 db to -20 db in 5 db divisions as indicated by dots appearing along the right side of the crt screen.

(6) When the SCALE switch is set to RMS, the voltage of a frequency component is determined by multiplying the pip height as indicated on the rms scale of the crt screen by the maximum voltage level as determined by the settings of the ATTENUATOR and SCALE MULTIPLIER controls. (Refer to table 2-3.)

FOR EXAMPLE: If a pip is at the 0.8 calibration point with the ATTENUATOR control at X1K and the SCALE MULTIPLIER control at X2.5, the rms level of the frequency component is:

0.8 x 2.5 = 2 volts rms

(7) When the SCALE switch is set the DB, the voltage of a frequency component is determined by multiplying the maximum voltage level as determined by the settings of the ATTENUATOR and SCALE MULTIPLIER controls (table 2-3) by the voltage ratio corresponding to the pip height as read on the DB scale of the CRT screen.

FOR EXAMPLE: If a pip is at the -15 DB calibration point with the ATTENUATOR control at X10K and the SCALE MULTIPLIER control at X2.5, the rms level of the frequency component is:

a. -15 db corresponds to a voltage ratio of 0.178
b. 0.178 x 25 volts equals 4.45 volts rms.

(8) If noise is present (beats between adjacent signals), making measurement difficult, proper setting of the VIDEO FILTER control is required. The proper choice of filter position is indicated by no change in pip amplitude.

2-20. NOISE MEASUREMENTS

2-21. In performing noise measurements, the same general techniques are used for setting the equipment as in spectral display measurements. (Refer to paragraph 2-18.) Additional front panel controls may be used as described below:

(1) In noise analysis, video filtering can be used to obtain smoothing of the noise spectrum envelope. Position 3 of the VIDEO FILTER control is provided for this purpose.

(2) Amplitude calibration for random signals are obtained on the Model SS-500 by use of an external calibrated noise generator. By comparing the relative amplitude of a random signal (noise) with that of a known random signal on the Model SS-500, precise measurements and analyses can be performed

SECTION III

THEORY OF OPERATION

3-1. INTRODUCTION

3-2. The Model SS-500 is a superheterodyne receiver whose detected output is displayed on a cathode ray tube. It covers the frequency range from 75 cps to 600 kc. The Model SS-500 displays the frequency of the applied signal along the horizontal axis while the amplitude of the signal is dispalyed linearly or logarithmically on the vertical axis. This section of the manual discusses the theory of operation for Model SS-500. It is divided into two parts, a simplified block diagram analysis and a detailed circuit analysis.

3-3. SIMPLIFIED BLOCK DIAGRAM ANALYSIS (See Figure 3-1)

3-4. The simplified block diagram shows only the basic elements that are necessary to explain the operation of the spectrum analyzer. The following description traces a signal through thi simplified network.

3-5. A signal applied to the Model SS-500 can be attenuated and then amplified to a suitable level. It is then mixed with a swept local oscillator signal, always 1.5 mc above the frequency of the incoming signal. The resultant 1.5 mc i-f difference frequency output is then filterdd, amplified, and detected. The detected signal is further amplified to drive the vertical deflection plates of a cathode ray tube. At the same time, a synchronizing sawtooth signal which sweeps the local oscillator also is applied to the horizontal deflection plates of the cathode ray tube, so that movement of the spot across the screen is proportional to the swept local oscillator frequency.

3-6. DETAILED CIRCUIT ANALYSIS (See Figure 3-2.)

3-7. The circuit stages shown in figure 3-2 essentially comprise the Model SS-500 Spectrum Analyzer. The following paragraphs detail the operation of each stage. (Refer to both the block diagram, figure 3-2, and the schematic, figure 4-3.)

3-8. ATTENUATOR AND OVERLOAD PROTECTION CIRCUIT. All input signals are applied through an attenuator circuit (R101 through R108) which permits a choice of five input ranges. This circuit is a calibrated voltage divider permitting incoming signals as large as 250 volts rms to be displayed on the cathode ray tube. A neon lamp V101 acts as a voltage regulator to prevent damage to the equipment if excessive voltage is applied to the Spectrum Analyzer.

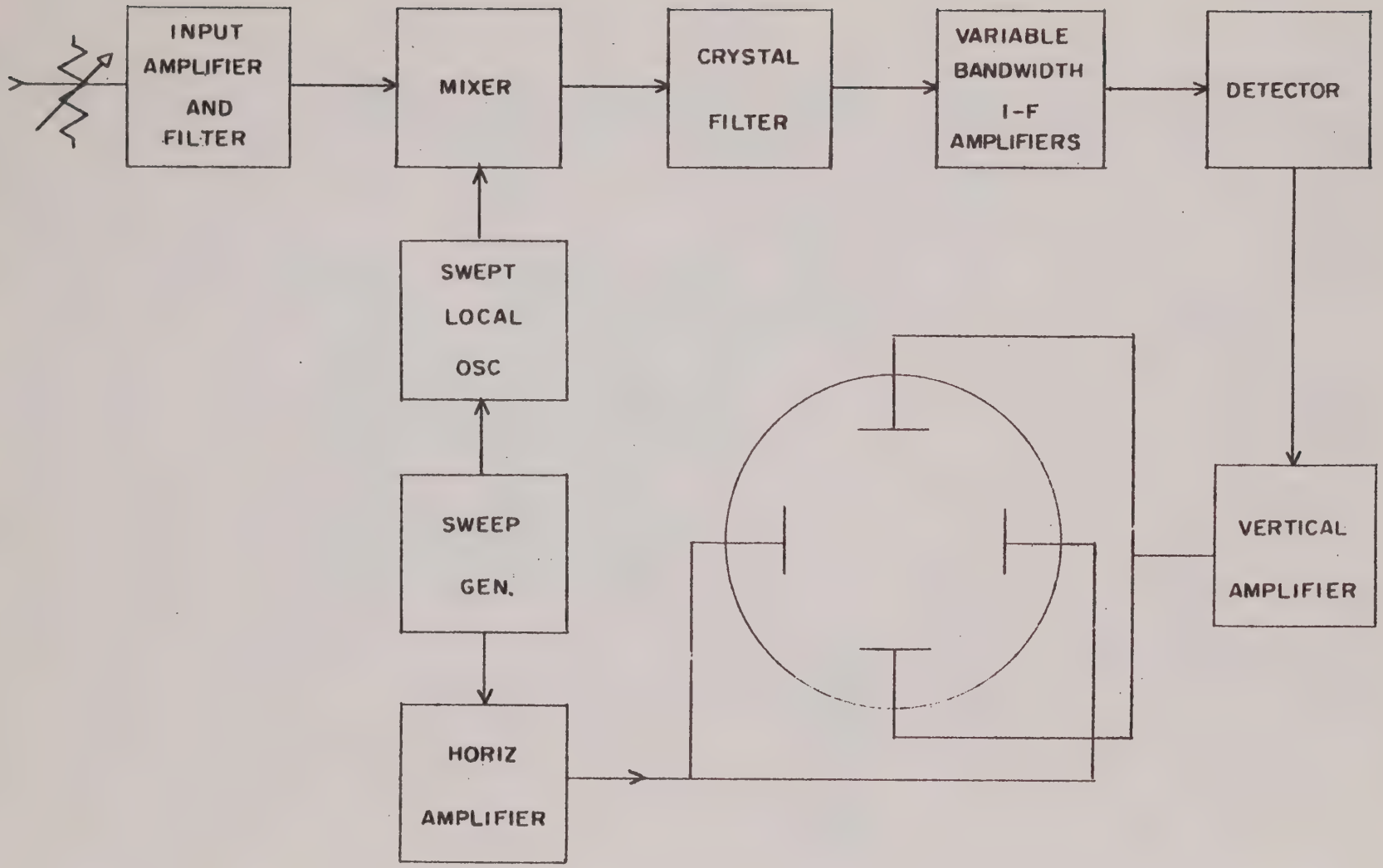


FIG 3-1 SIMPLFIED BLOCK DIAGRAM

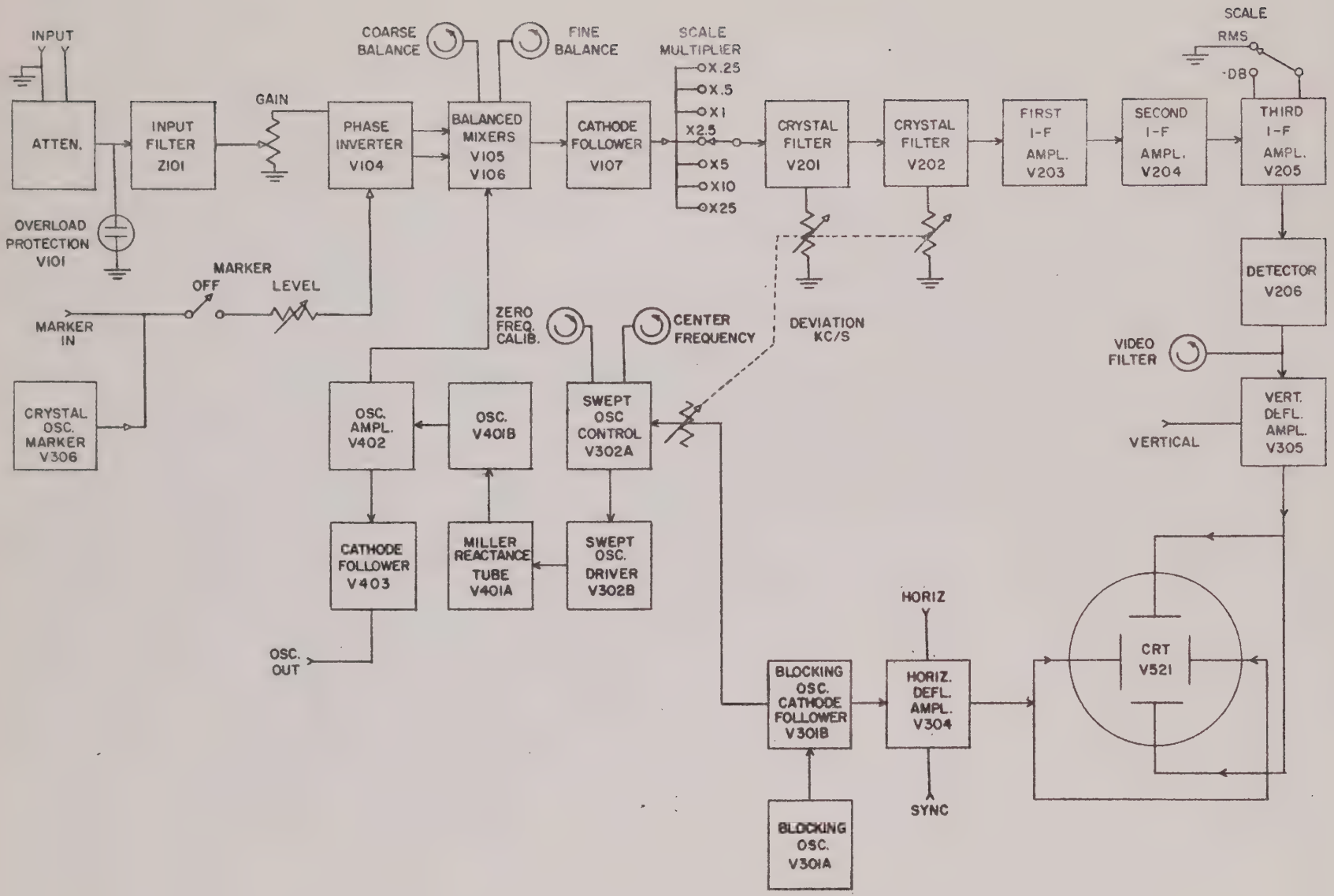


FIGURE 3-2 DETAILED BLOCK DIAGRAM

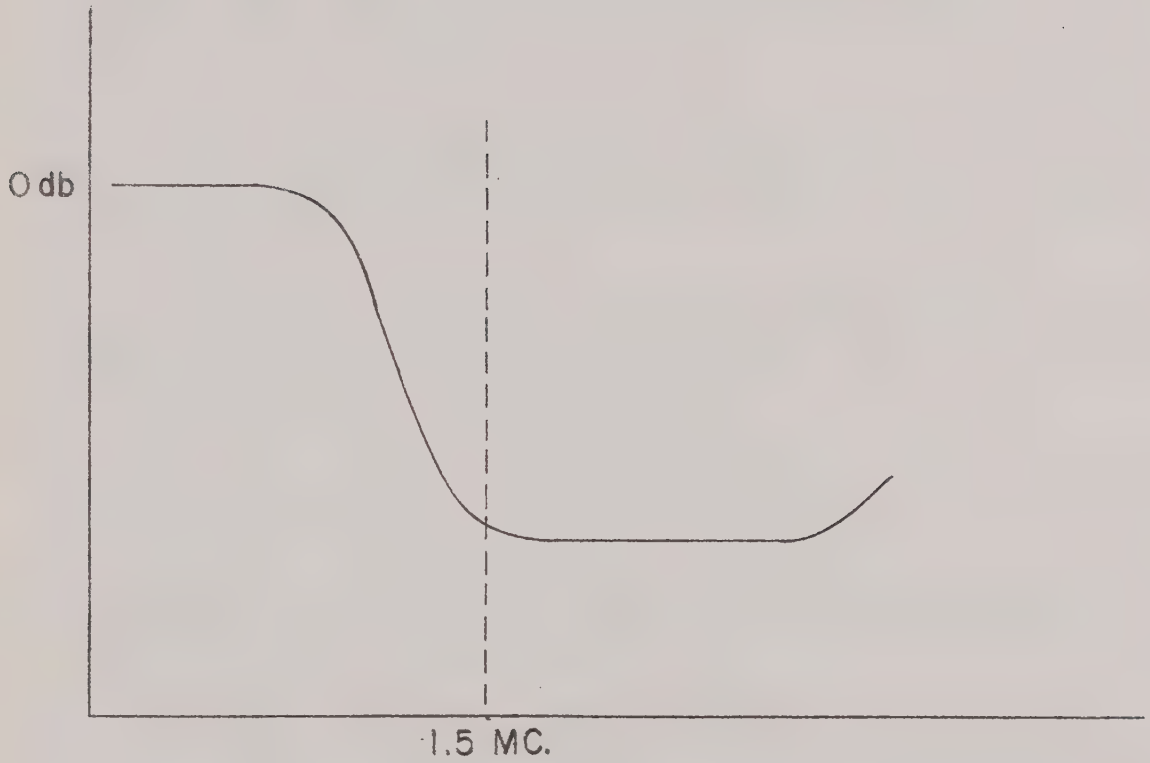


FIGURE 3-3 FILTER BANDPASS CHARACTERISTIC

3-9. INPUT FILTER V103. The input filter V103 serves to reject spurious signals at or above the i-f frequency (1.5 mc) from being displayed on the cathode ray tube. This circuit is a notch filter with a bandpass characteristic as shown in figure 3-3. The output of the filter is applied to phase inverter V104.

3-10. PHASE INVERTER V104. The ouput of filter V103 is applied through capacitor C104 and GAIN control R114 to the grid of phase inverter V104. Tube V104 produces two outputs (one at the plate and one from the cathode) 180 degrees out-of-phase with each other.

3-11. The GAIN control adjusts the displayed amplitude of the signal. When rotated fully clockwise (maximum gain), absolute voltage measurements can be made of the displayed signal. Harmonic balance potentiometer R119 is used to cancel out any harmonic components in tube V104.

3-12. For frequency calibration purposes, a 100-kc marker signal from tube V306 can be applied to the control grid of tube V106. External markers can be also applied to tube V106, via jack J305 (with MARKERS switch in the ON positions).

3-13. The plate output of tube V104 is coupled to the grid of balanced mixer V105, while the cathode output of tube V104 is coupled to the grid of balanced mixer V106.

3-14. BALANCED MIXERS V105 AND V106. Tubes V105 and V106 are used to heterodyne the local oscillator signal with the incoming signal and apply the resultant difference signal of 1.5 mc to the i-f circuits.

3-15. The local oscillator signal (1.5 mc plus the frequency of the incoming signal) is applied from tube V402A to the cathodes of balanced mixers V105 and V106. Since the local oscillator signal is applied to both tubes in phase, they cancel out in the push-pull plate tank circuit oscillator carrier. The resultant side bands are 180 degrees out-of-phase with each other but are additive in the plate tank Z102.

3-16. Since the plate tank Z102 is tuned to the i-f of 1.5 mc, only sidebands at this i-f frequency appear at the balanced mixers output. Balance controls R132 and R138 are used to set the proper voltage on the screen of V105 and V106, and correct the impedance in the plate circuit which suppresses the local oscillator carrier. Capacitor C107 and resistor R121 insure correct impedance in the grid circuit for best balance. The secondary of the plate tank circuit Z102 applies the i-f signal to cathode follower V107.

3-17. CATHODE FOLLOWER V107. Tuve V107 provides a low impedance source for the 1.5 mc i-f signal to the i-f amplifier stages. It also acts to isolate the gain calibrate control, R201, and SCALE

MULTIPLIER control S201 from the balanced mixer load coil to prevent any detuning with change of control settings.

3-18. The output of the cathode follower is applied through a gain calibration control R201 and the SCALE MULTIPLIER control S201 to crystal filter driver V201. Control R201 varies the amplitude of the i-f signal fed to the IF amplifiers to adjust for full scale deflection of signal pip to maintain amplitude calibration of the equipment.

3-19. CRYSTAL FILTER DRIVERS V201 and V202. The output of tube V107 is applied by one of three positions of SCALE MULTIPLIER control S201 to the grid of the first crystal filter driver V201. The selectivity of the Spectrum Analyzer is regulated by varying the bandwidth of the two 1.5 mc crystal filters Y201 and Y202 which insures optimum resolution at all sweep widths.

3-20. The signal input from the cathode of V201 is fed through capacitor C203 and the 1.5 mc crystal filter Y201 to the grid of the second crystal driven filter amplifier V202. Simultaneously, the output from the plate of V201 (amplified i-f signal) is coupled through neutralizing capacitor C202 (to neutralize crystal holder capacity) to the grid of tube V202. A load tank circuit L201, C204, and R212 acts as a resistance in series with crystal Y201 to control the crystal filter bandwidth. Resolution controls R210 and R211 are across the tank circuit and vary the series resistance and bandwidth. R210 is geared with the DEVIATION control to insure optimum resolution for all deviation settings.

3-21. Tube V202 performs in an identical manner as tube V201. Its output from the plate is coupled to the grid of the first i-f amplifier V203.

3-22. IF AMPLIFIERS V203, V204, AND V205. The output of the second crystal driven filter amplifier V202 is applied to the grid of the first i-f amplifier V203. The signal is amplifier and applied to the grid of second i-f amplifier V204 through i-f transformer Z201. The second i-f amplifier V204 also amplifies this signal; however, the amplification of this stage is tracked to the resolution and deviation controls. Gain tracking control R226 is automatically adjusted for minimum resistance when the DEVIATION control is tuned to minimum deviation with a resultant constant overall gain for all bandwidth settings. Gain compensation control R225 sets the proper amplification range over which the gain tracking control will operate.

3-23. The output of the second i-f amplifier V204 is coupled through the second i-f transformer Z202 to the grid of the third i-f amplifier V205. The third i-f amplifier V205 has two modes of operation. In the SCALE-RMS position, V205 acts as a linear amplifier; in the DB position, V205 has an amplification curve that approximates a log characteristic.

3-24. When the SCALE switch S202 is in the RMS position, the grid of V204 is grounded through the secondary of transformer Z202 and resistor R232. This causes V205 to amplify the i-f signal in a linear manner.

3-25. With the SCALE switch in the DB position, a portion of the detected signal from tube V206 is applied through R243, filtering network R242, C228, R232, and C219, to the grid of V205. At the same time, the screen voltage of V205 is changed to a value required for proper gain characteristics. Controls R243 and R241 are set to shape the logarithmic output of V205. The output of V205 is coupled through the third i-f transformer Z203 to the cathode of detector V206.

3-26. DETECTOR V206. The output of the third i-f amplifier stage is applied to the cathode of detector V206. Here the i-f signal is rectified and filtered. Voltage divider R237 and R238 in tank circuit Z203 applies a small positive voltage to the cathode of V206 to insure a more linear operation.

3-27. When a signal is fed to the cathode of V206, current flows only during the negative half of the input cycle. The rectified i-f output at the plate of V206 is filtered by R243 and C227. This rectified output signal follows the peaks of the i-f frequency. These peaks approximate the bandpass characteristics of the i-f crystal filters.

3-28. The rectified output signal is applied through voltage divider R244 and R245 and an additional high frequency filter R246 and C304 to the grid of the vertical deflection amplifier V305.

3-29. VERTICAL DEFLECTION AMPLIFIER V305. The rectified signal output of V206 is applied to the grid of V305 for amplification to drive the vertical deflection plates of the cathode ray tube. The input signal of V305 can be filtered (via VIDEO FILTER control S301) by capacitors C304, C305, C306, or C307 which act as a low-pass filter to eliminate high frequency signals and beat interference.

3-30. The output of detector V206 applies a negative signal pulse to the grid of V305A. Negative voltage is applied to the grid of V305B, through voltage divider R338 and R337. Vertical position control R337 adjusts the negative voltage on V305B. This change of voltage on the grid of V305B changes the plate potential with a resultant change of vertical position on the cathode ray tube.

3-31. LOCAL OSCILLATOR V401 THRU V403. Tube V401 serves as the local oscillator, in that it provides a signal between 2.0 and 1.5 mc to heterodyne with the incoming signal. Tube V402 amplifies and couples the local oscillator signal to balanced mixers V105 and V106 and also makes the local oscillator signal available as a signal source for external equipments, via tube V403.

3-32. Dual triode V401 functions as a Miller reactance tube (A section) and as a Hartley oscillator (B section). The Miller reactance tube V401A varies the oscillator frequency from 2.0 to 1.5 mc. This tube is essentially an electronically varying capacitor across tank circuit Z401 with the frequency variation being controlled by the center frequency dc voltage and deviation ac sweep. Tube V401B maintains its oscillations through tank circuit Z401 and applies its output to the grid of tube V402A.

3-33. The amplified signal from tube V402 is fed to the cathodes of balanced mixers and to the grid of cathode follower V403. The cathode of tube V402A is tied to ground which limits the signal swing with a nearly constant amplitude output.

3-34. The signal from the cathode follower V403 is fed to the OSC. OUT jack to provide a signal source for external equipments such as the Probescope Model SG-500 Synchronous Sweep Generator.

3-35. BLOCKING OSCILLATOR V301. The blocking oscillator provides a timing reference voltage (sawtooth) for the horizontal deflection amplifier V304 and the sweep circuit V302. This sawtooth voltage has a fixed repetition rate of three sweeps every second set by rate control R301.

3-36. The voltage at the terminal of capacitor C302 and resistor R305 is a linear sawtooth and is applied through a voltage divider consisting of resistors R304 through R307. Resistor R305 acts as a maximum sweep width adjustment since variation of this control varies the amplitude of the sawtooth applied to sweep oscillator circuit V302. The junction of resistors R306 and R307 feeds the sawtooth to the horizontal deflection amplifier V304.

3-37. SWEPT OSCILLATOR CONTROL V302. The Swept Oscillator Control regulates the sawtooth from tube V301 for controlling the frequency and sweep (deviation) of the local oscillator signal.

3-38. Sawtooth voltage is coupled from Pin 8, V301 through I521, R314 and R308 to point A, as shown in Fig. 3-4. R308 is adjusted for zero average voltage of the sawtooth at point A. I521 is used to rpovide a d.c. voltage drop without affecting the amplitude or waveshape of the sawtooth signal.

3-39. The d.c. voltage at point D is controlled by the position of the arm of the CENTER FREQ. control, R318. Since the values of R601 and R602 are equal, and the Values of R319 and R320 are also equal, the d.c. difference of potential between points B and C is effectively zero, and any variations of resistance in R305, R309, and R313 will not effect the d.c. voltage appearing at Pin 7 of V302B. Therefore, this d.c. voltage will vary with the center frequency control and will be approximately one-half of the voltage appearing at point D. The deviation control, R312, will control the amplitude of the sawtooth superimposed upon this d.c. voltage at Pin 7 of V302B.

3-40. This composite signal is applied to the Swept Local Oscillator from the cathode of V302B. The d.c. level determines the center frequency of the oscillator and the sawtooth amplitude determines the sweep width.

3-41. HORIZONTAL DEFLECTION AMPLIFIER V304. Tube V304 is a twin-triode amplifier functioning as a cathode-coupled push-pull balanced amplifier. The use of a balanced amplifier insures proper linearity and minimum distortion of the horizontal sweep voltage.

3-42. The sawtooth is fed from a voltage divider in the cathode circuit of tube V301B to line size control R322. Adjustment of this control results in a change in magnitude of the sawtooth to the grid of V304A. Tube V304A acts as an amplifier, while tube V304B acts as an inverter and amplifier to produce a signal of the same amplitude but of opposite polarity at the plate of tube V304A. The sawtooth output of V304A and V304B is applied to the horizontal deflection plates of the cathode ray tube.

3-43. Horizontal positioning of the trace is effected by means of potentiometer R327 and line size by means of R322. The sawtooth at the cathodes of V304 is made available at the horizontal output jack J301 through resistor R331. The sawtooth output from V304B is differentiated by C308, R332, and R333, to provide a sync pulse at the sync jack J302.

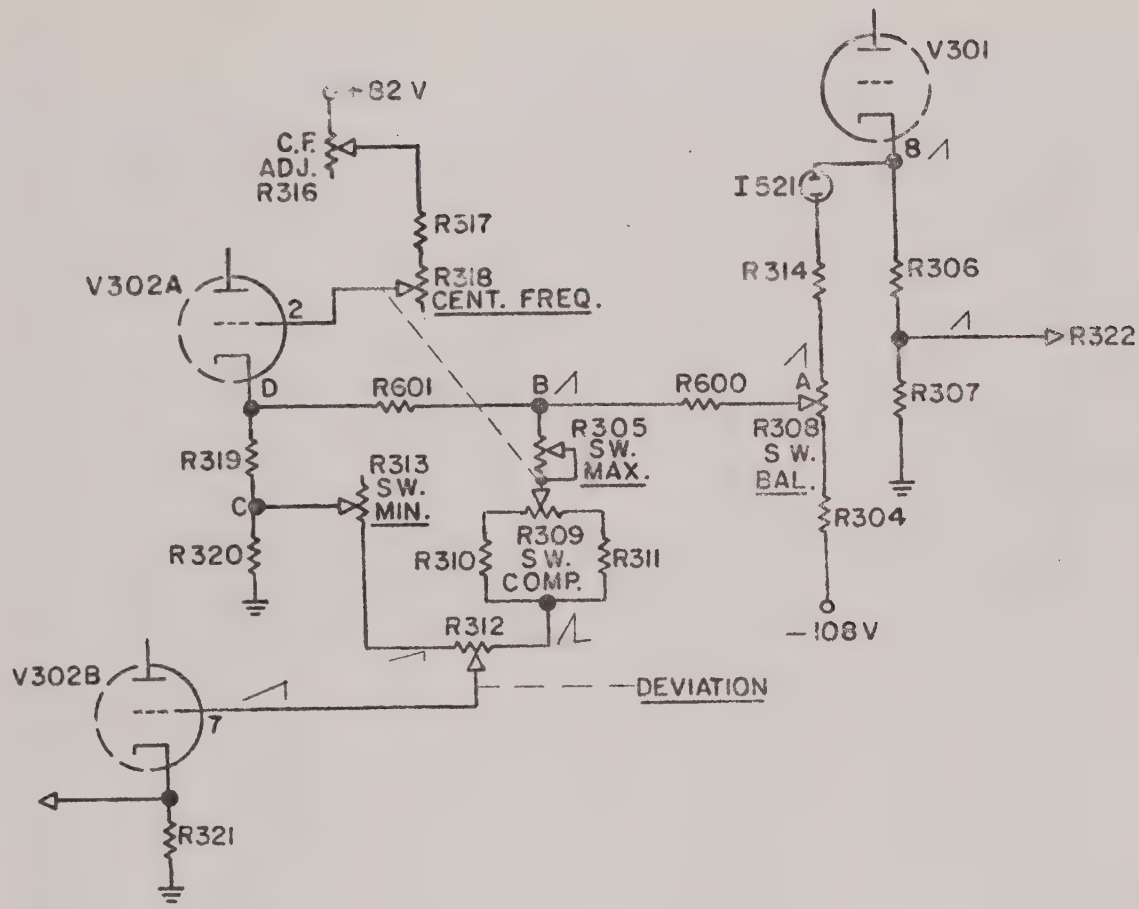


FIGURE 3-4 SWEPT OSCILLATOR CONTROL

3-44. MARKER OSCILLATOR V306. Tube V306 is used to generate a 100-kc marker for calibrating a signal displayed on the cathode ray tube. The marker oscillator is a Pierce oscillator utilizing a 100-kc crystal Y301. The crystal-controlled marker signal from the grid of V306 is fed through isolation filter C313 and R342 to the MARKER switch. R343 and C314 isolate an external marker from tube V306. The 100 kc signal is applied to the grid of V106 when the MARKERS switch is in the ON position.

3-45. CATHODE RAY TUBE V521. Tube V521 is a long-persistence cathode ray tube and by use of an orange filter it gives a bright yellow trace without any notable halo. The cathode ray tube operates with approximately 2,100 volts of accelerating potential. A negative 800 volts is applied to the filament and control grid and to the cathode through intensity control R517. A negative voltage is also applied to the first anode through voltage divider R519 and focus control R520. A positive voltage is applied to the third anode from the junction of R501 and C502.

3-46. In order to insure proper focus on the face of the cathode ray tube, the second anode is kept at roughly the same dc potential as the horizontal and vertical deflection plates. This is accomplished by dividing a portion of the B+ supply through the astigmatism control R522 to the second anode.

3-47. POWER SUPPLIES. (See Figure 3-5) The Model SS-500 power supply consists of six separate supplies:

1. +1300 volts dc crt supply
2. -800 volts dc crt supply
3. -105 volts dc B- supply
4. +270 volts dc B+ supply
5. +107 volts dc filament supply
6. 6.3 volts ac supply

3-48. CATHODE RAY TUBE POWER SUPPLY. For the high-voltage, low-current requirements of the cathode ray tube, a diode rectifying circuit is employed to produce the crt power supply. The output voltage appearing across the secondary of transformer T502 is tapped and applied to high voltage diodes CR502 and DR503. The output of this network, which produces the +1300 and -800 volts dc required, is applied to the various accelerating and control grids of the cathode ray tube.

3-49. Discharge resistors R502 and R535 are provided across the positive 1300 volts dc supply as a means to discharge the high-voltage when power is disconnected.

3-50. Filter network R501 and C502, and C501, R503, and C503 reduce the ac ripple content of the high voltage supply to a minimum.

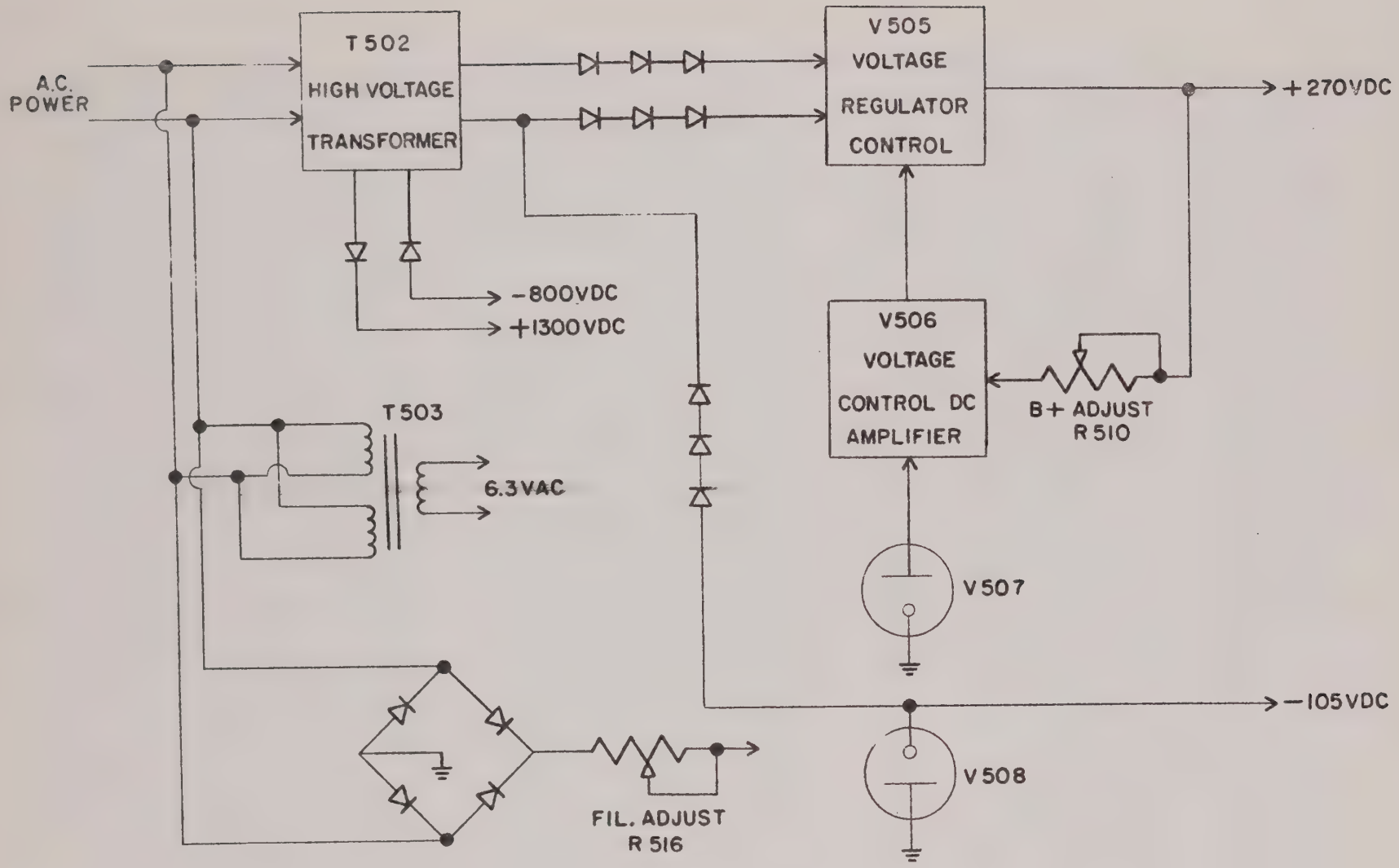


FIGURE 3-5 POWER SUPPLIES SIMPLIFED BLOCK DIAGRAM

3-51. B- SUPPLY. A -105 volts dc supply is required for biasing various circuits throughout the equipment. The supply is derived from a secondary tap of transformer T502, which is rectified by diodes CR506, CR505, and CR504. The rectified ac voltage is filtered by R513, C508, and R514 and regulated by voltage regulator tube V508.

3-52. The current that passes through voltage regulator V508 also passes through resistor R515. If the -105 volts dc supply tends to drop, the voltage across V508 tends to drop. However, the gas in tube V508 deionizes slightly and less current passes through this tube. The current in resistor R515 is decreased by the amount of the current decrease in tube V508. Since the current in resistor R515 is less, the voltage drop across resistor R515 is also less and the voltage across the load is held nearly constant.

3-53. B+ SUPPLY. The +270 volts dc supply is a series type degenerative regulator consisting of transformer T502, diodes CR507 through CR512, voltage control tube V505, voltage control dc amplifier tube V506, and voltage regulator tube V507.

3-54. The ac input is stepped-up by transformer T502 to approximately 450 volts. This voltage is rectified by diode network CR507 through CR512; filtered and applied to the plates of voltage controls tube V505. The B+ adjustment control R510 is set to produce an output voltage of +270 volts dc. The setting of this control determines the value of bias applied to control grid of dc amplifier V506. Any change in the output voltage because of loading or line voltage variations cases a like change in the bias applied to the control grid of V506. Changing the bias of V506 changes the current flowing in the plate circuit, which in turn changes the bias applied to the grids of control tube V505. Changing the bias of V505 changes its plate resistance which causes the B+ supply voltage to return to normal. Voltage regulator V507 provides the necessary reference voltage for the operation of dc amplifier V506.

3-55. FILAMENT SUPPLY. The +107 volts dc filament supply is derived from a full-wave rectifier bridge configuration. This supply furnishes the filament voltage for most tubes in the equipment. The input voltage is rectified across balanced bridge rectifier CR513 through CR516. It is adjusted by fialment control and filtered by capacitor C509 to keep the fialment ripple to a minimum. Neon indicator V509 through V514 are placed across tube sections to indicate open filaments. Filtering caiacitor C510 is placed in the filament string to further reduce any ripple present.

3-56. CRT EDGE LIGHTING. A 6.3 volts ac supply is provided to furnish the edge lighting for the cathode ray tube screen. The input voltage is stepped-down across transformer T503 and is applied to edge lighting lamps V517 through V520. This supply also provides for the filament of V505, and for the indicator lamps, V515 and V516, located above the center frequency and deviation controls.

SECTION IV

MAINTENANCE

4-1. GENERAL

4-2. This section contains procedures to be followed for maintaining the equipment in operating condition. Included are: Test equipment, minimum performance standards, circuit trouble shooting procedures, tube replacement touch-up procedure, adjustment and alignment instructions, removal and replacement instructions, schematic, and voltage and resistance charts. It is extremely important that this section of the manual be read thoroughly before performing maintenance procedures.

4-3. TEST EQUIPMENT

4-4. Table 4-1 lists the test equipment required to check out the operation of the Model SS-500 and to determine the defective circuit or component, if the equipment becomes inoperative. Test equipment of equivalent characteristics can be substituted for the suggested test equipment listed in table 4-1. In any event, all test equipment used must be in good operating condition and properly terminated when required.

4-5. MINIMUM PERFORMANCE STANDARDS

4-6. Table 4-2 details the minimum performance standards for the Model SS-500. The minimum performance standards determine if the equipment is operating satisfactorily upon receipt, repair, or long periods of storage.

Step	Purpose	Procedure	Normal Indication	Probable Cause if Indication is Abnormal
1	Determine if power is being applied and cathode ray tube edge lighting variation.	Apply a nominal 115 volts ac, single phase 60 cps, power source (thru line voltage regulator) to equipment. Turn POWER control clockwise.	Note crt edge lighting varies with rotation of POWER control. Within a short period of time a dot will appear and begin moving across the screen.	Table 4-3, steps 1 thru 3.
2	Determine whether crt display is operating.	Set front panel controls to: SCALE--RMS MARKERS--OFF CENTER FREQ.--0 DEVIATION KC/S--100 Allow at least 30 minutes for zero-frequency pip to stabilize.	Zero frequency pip directly over center graticule.	Refer to paragraph 2-9. If still improper, refer to table 4-3, steps 8 and 9.
		Observe zero-frequency pip presentation.	A sharp, proper brilliance, uniform trace, positioned properly on screen.	Refer to paragraph 2-10. If still improper, refer to table 4-3, steps 3 thru 7.
		Adjust BALANCE controls (refer to paragraph 2-12) for reduction of zero-frequency pip height.	Pip can be appreciably reduced in height.	Refer to table 4-3, step 12.
		Rotate DEVIATION KC/S control.	Zero-frequency pip widens or becomes narrower depending upon rotation.	Refer to table 4-3, step 10.

Figure 4-2. Minimum Performance Standards (Sheet 1 of 2)

Step	Purpose	Procedure	Normal Indication	Probable Cause if Indication is Abnormal
2 contd.		Set CENTER FREQUENCY control to 100. Place MARKERS switch to ON.	A marker pip appears at center of screen.	Refer to table 4-3, step 10.
		Set front panel controls to: DEVIATION KC/S--Max. CENTER FREQ.--100 SCALE MULTIPLIER--X2.5 ATTENUATOR--1K GAIN--Fully Clockwise VIDEO FILTER--OFF		Refer to table 4-3, step 12.
		Apply a 2.5 volts, 100kc calibrated signal to the equipment.	A full-scale signal pattern is displayed directly over center graticule.	
		Rotate GAIN control counter-clockwise. Reset GAIN control fully clockwise.	Signal decreases in height with rotation of control.	GAIN control defective.

Figure 4-2. Minimum erformance Standard (Sheet 2 of 2)

WARNING

HIGH VOLTAGES DANGEROUS TO HUMAN LIFE
ARE PRESENT IN THE EQUIPMENT. PERSONNEL
MUST OBSERVE SAFETY PRECAUTIONS AT ALL TIMES.

4-7. CIRCUIT TROUBLE SHOOTING PROCEDURES

4-8. The circuit trouble shooting procedures are listed in table 4-3. This procedure follows the procedures given in table 4-2, the minimum performance standards. The probable cuases for the symptoms listed in table 4-3 are given in the order of their probable occurance. The defective component or circuit is located in table 4-3 together with the remedy for correcting the malfunction. In some cases, the defect cannot be attributed to a particular component within the i-f circuit. Reference is also made to the system trouble shooting procedures, when required.

4-9. It a tube is replaced, refer to table 4-5 for any touch-up procedure required. Always check performance of the particular stage to determine if a touch-up is required.

4-10. As an aid to the maintenance technician, neon indicators V509 through V514 have been placed across most tube filaments in the equipment. If a tube filament becomes open, its associated neon indicator will become illuminated, pin-pointing the defective filament section.

4-11. When trouble shooting a particular tube circuit, always first ascertain that the proper voltages are being supplied to all tube elements. Many questions concerning the condition of a tube in a given circuit can be answered by substituting a tube known to be free from defects in palce of questionable tube and comparing the performance of the equipment.

Step	Trouble	Probable Cause	Remedy
1	No power being applied to equipment when POWER control is rotated clockwise.	No ace power input	1. Check line regulator. 2. Check power cord. 3. Check power connection to equipment.
		Fuses defective.	Check fuses. Replace if defective. Never replace a fuse with one of a higher current rating. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been determined and trouble has been corrected.
		POWER switch S501 defective.	Check continuity of switch S501, replace if defective.
		Power supply component defective.	Refer to paragraph 4-12 and step 1.
2	Screen illumination (edge lighting) is off or does not vary with rotation of POWER control.	Defective control R528 or edge lighting circuitry.	Check continuity of R528, transformer T503, and/or lamps V515 through V520. Replace defective component.
3	Low intensity of trace.	Defective high voltage power supply.	Refer to paragraph 4-12, step 1.
		Defective CRT.	Replace CRT and/or associated defective component.
4	Erratic or no trace.	Horizontal deflection amplifier V304.	Replace tube V304 and/or associated defective circuitry.
		B+ or B- power supply.	Refer to paragraph 4-12, step 1. Refer to paragraph 4-12, step 3.

Table 4-3. Circuit Trouble Shootin Table (Sheet 1)

Step	Trouble	Probable Cause	Remedy
5	Trace cannot be properly positioned.	Horizontal or Vertical deflection amplifier V304 or V305.	Replace defective tube and/or associated defective circuitry.
		B+ or B- power supply.	Refer to paragraph 4-12, step 1.
6	AC hum on baseline	Defective crt shield.	Correct as required.
		B+ or B- filter capacitor C504 thru C508	Replace defective capacitor.
7	Intensity modulation on trace.	High voltage filter capacitor C501 thru C503.	Replace defective capacitor
8	Zero-frequency pip and applied signal not displayed on screen.	Local Oscillator	Refer to paragraph 4-12, step 7.
		Balanced Mixers V105 or V106.	Replace defective tube and/or associated defective circuitry.
		I-F Circuit.	Refer to table 4-4.
9	Zero-frequency pip on screen but no input signal pip (s) appears.	Defective ATTENUATOR switch S101.	Replace switch or associated components.
		Input Amplifier V104.	Replace tube and/or associated defective circuitry.
		Input Filter Z101.	Replace if found defective.
10	No deviation of signal pip with rotation of DEVIATION KC/S control.	Defective gear train assembly (planetary drive slipping or loose coupling on gear train).	Repair as required.
		Broken lead on DEVIATION KC/S control.	Correct as required.
11	Input signal(s) do not appear at correct frequency points	Local Oscillator	Refer to paragraph 4-12, step 7.

Table 4-3. Circuit Trouble Shooting Table (Sheet 2 of 3)

Step	Trouble	Probable Cause	Remedy
12	Loss in Sensitivity.	I-F Circuit	Refer to table 4-4.
		Local Oscillator.	Refer to paragraph 4-12, step 7.
		Input Filter Z101 or V104.	Replace defective filter or tube.
		Balanced Mixers V105 or V106.	Replace defective tube.
13	Selectivity (resolution) improper.	Crystal filter V201 or V202.	Replace defective tube or crystal.
14	No marker pip(s) on screen with MARKERS switch on ON position.	Crystal oscillator V306 or Y301	Replace defective tube V306 or crystal Y301.
15	Logarithmic display not correct (linear display correct)	SCALE switch S202 and/or log shaping circuit.	Replace defective component.
16	Frequency shift with rotation of DEVIATON KC/S control.	Improper setting of S.W. balance (R308)-R600 and R601 not matched-R319 and R320 not matched.	Refer to paragraph 4-30, replace defective component.

Table 4-3. Circuit Trouble Shooting Table (Sheet 3 of 3)

Step	Trouble	Procedure	Normal Indication	Probable Cause of Trouble
1	I-F Circuit	Set front panel controls to: GAIN--Fully clockwise DEVIATION--Max. CENTER FREQ.--500 SCALE--RMS SCALE MULTIPLIER--X0.25 VIDEO FILTER--OFF Apply a 1.5 mc, 0.07 mv signal to pin 6 of tube V201. Adjust frequency of applied signal for maximum vertical rise of trace.	A baseline deflection to the top of the graticule.	If indication is improper, proceed to step 2.
2		Apply a 1.5 mc, 0.06 mv signal to pin 6 of tube V202.	A baseline deflection to the top of graticule.	If indication is normal replace tube V201 and/or defective associated circuitry. If indication is abnormal, proceed to step 3.
3		Apply a 1.5 mc, 0.04 mv signal to pin 1 of tube V203.	A baseline deflection to the top of the graticule.	If indication is normal, replace tube V202 and/or associated defective circuitry. If indication is abnormal, proceed to step 4.
4		Apply a 1.5 mc, 5 mv signal to pin 1 of tube V204.	A baseline deflection to the top of the graticule.	If indication is normal, replace tube V203 and/or defective associated circuitry. If indication is abnormal, proceed to step 5.

Table 4-4. I-F Circuit Trouble Shooting Table (Sheet 1 of 2)

Step	Trouble	Procedure	Normal Indication	Probable Cause of Trouble
5	I-F Circuit (contd.)	Apply a 1.5 mc, 70 mv signal to pin 1 of tube V205.	A baseline deflection to the top of the graticule.	If indication is normal, replace tube V204 and/or defective associated circuitry. If indication is abnormal, proceed to step 6.
6		Apply a 1.5 mc, 6 volt signal to pin 7 of tube V206.	A baseline deflection to the top of the graticule.	If indication is abnormal, replace tube V206 and/or defective associated circuitry. If indication is normal, replace tube V205 and/or defective associated circuitry.

Table 4-4. I-F Circuit Trouble Shooting Table (sheet 2 of 2)

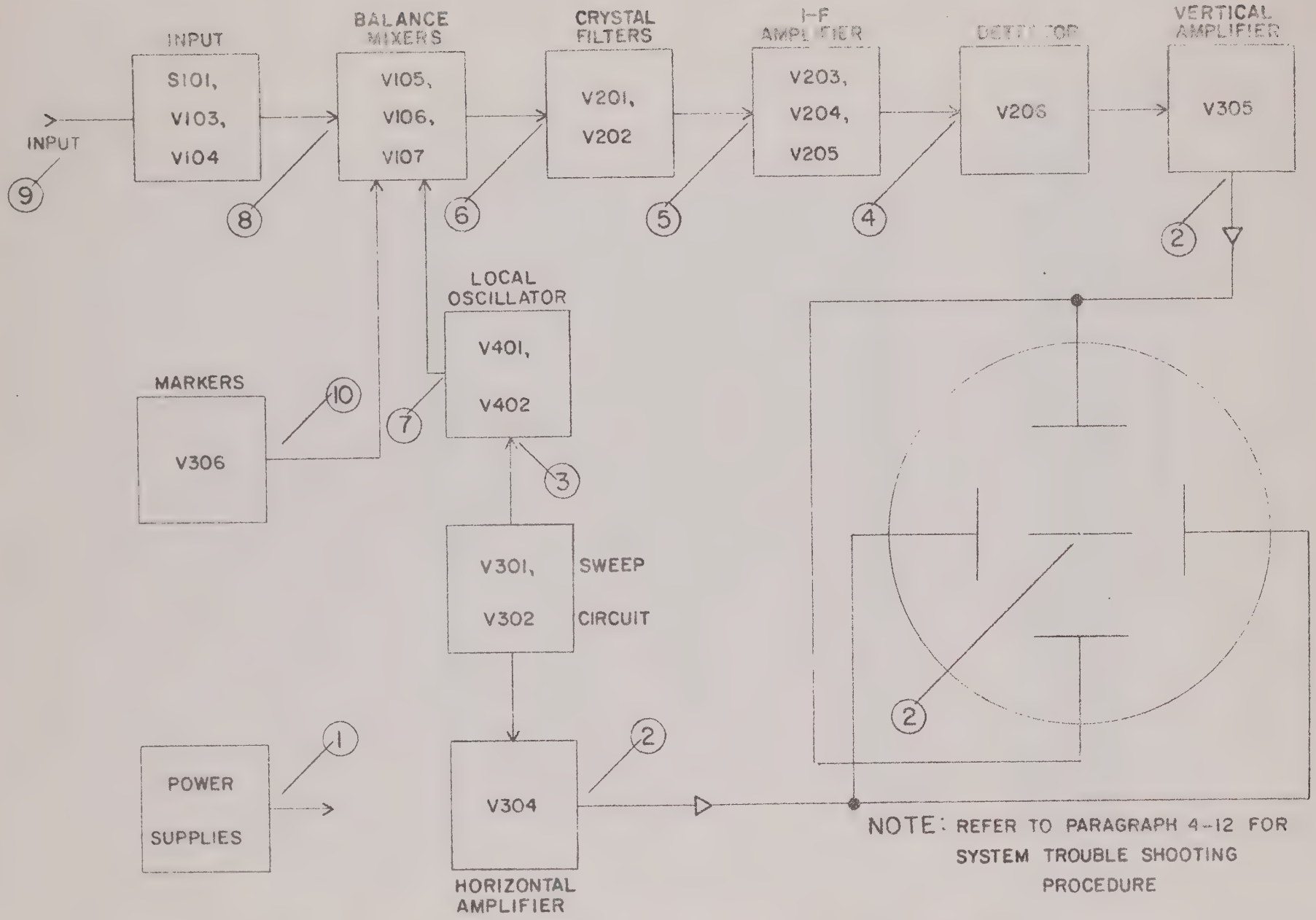


FIGURE 4-1 SYSTEM TROUBLE SHOOTING BLOCK DIAGRAM

4-12. SYSTEM TROUBLE SHOOTING PROCEDURES

4-13. The following procedure should be used to isolate an equipment malfunction to a particular stage as shown in Figure 4-1. This procedure checks out all the circuitry of the Model SS-500 and is to be followed when an equipment malfunction cannot be located by using the detailed trouble shooting procedures given in tables 4-3 and 4-4.

NOTE

All internal adjustment controls have been factory set for optimum equipment operation. Therefore, in isolating a trouble, adjustment of these controls should <u>not</u> be made.

4-14. Set the front panel controls to:

VIDEO FILTER	-	OFF
DEVIATION KC/S	-	Maximum
CENTER FREQUENCY	-	100
GAIN	-	Fully clockwise
ATTENUATOR	-	X1
SCALE MULTIPLIER	-	X0.25
SCALE	-	RMS
MARKERS	-	OFF

4-15. Turn POWER switch to ON and allow 30 minutes for equipment to warm up.

NOTE

The following steps are numbered in the same relationship as shown in Figure 4-1.

(1) Check power supplies as indicated in the table below:

Multimeter Connected Between Ground and	Power Supply Being Checked	Indication Min. vdc	Max.	Adjust.
J504	+270 vdc	+270	+270	R510
V508, pin 2	-105 vdc	-100	-115	None
Junction of C502 and R502	+1300 vdc	+1250	+1350	None
Junction of C503 and R503	-800 vdc	680	830	None
J503	Filament	+107	+107	R516

If any of the above power supply voltages cannot be obtained (even after adjustment), trouble shoot the associated circuit of the defective power supply for defective tube(s) and/or components. If all indications ar normal, proceed to step 2.

(2) Check the sweep circuit by observing if a trace or dot is visible on the crt screen. If the trace is observed, proceed to step 3. If the dot is present only, follow the procedure below:

a. Connect a multimeter between pin 1 of tube V304 and ground; connect another multimeter between pin 6 of tube V304 and ground. Rotate Hor. Pos. control R327 and note that the two voltages indicated on the multimeters can be brought within 10% of each other. If improper, replaced tube V304 and/or associated defective circuitry.

b. Connect the multimeter between pin 1 of tube V305 and ground; connect the other multimeter between pin 6 of tube V305 and ground. Rotate Vert. Pos. control R337 and note that the two voltages indicated on the multimeters can be brought within 10% of each other. If improper, replace tube V305 and/or associated defective circuitry.

c. Check cathode ray tube and associated circuitry for defective components.

(3) Connect an oscilloscope to pin 5 of P401 in the local oscillator assembly. With the DEVIATION KC control at 100 the display should be as shown below. If proper, proceed to step 4. If improper, replaced tube V301 or V302 and/or defective associated circuitry.

(4) Apply a 1.5 mc, 6 volt signal (calibrated) to pin 7 of V206. A horizontal baseline rise of 10 boxes should be observed on the crt screen. If improper, replace tube V206 and/or defective associated circuitry. If proper, proceed to step 5.

(5) Apply a 1.5 mc, 0.04 mv signal to pin 1 of tube V203. A full scale baseline deflection should be observed on the crt screen. If improper, replace tube V203, V204, or V205 and/or defective associated circuitry. If proper, proceed to step 6. (Refer to table 4-4 for more detailed trouble shootin procedure of the i-f amplifier).

(6) Apply a 1.5 mc, 0.07 mv signal to pin 6 of V201. Adjust the frequency of the applied signal for maximum horizontal width display of the signal on the crt screen. A full-scale baseline deflection should be observed on the crt screen. If improper, replace tube V201 or V202 and/or defective associated circuitry. (Refer to paragraph 4-29 for alignment of the crystal driven filter amplifiers if crystal Y201 or Y202, or an associated component was replaced) If proper, proceed to step 7.

(7) Connect the oscilloscope to pin 1 of V402. A 1.8 volt sweeping sine wave signal should be observed on the oscilloscope. If improper, replace tube V401 or V402 and/or associated defective circuitry. (Refer to paragraph 4-31 for alignment of the local oscillator if a component was replaced) If proper, proceed to step 8.

(8) Apply a 1.5 mc, 0.015 mv signal to pin 1 of V105. Apply the same signal to pin 1 of V106. Note a full-scale baseline deflection in each case. If improper, replace tube V105 or V106 and/or associated defective circuitry. If proper, proceed to step 9.

(9) Apply a 100-kc, 250 microvolt signal (calibrated) to the INPUT/GND receptacles. Note a full-scale pip deflection. If improper, replace tube V103 or V104 and/or associated defective circuitry. (Refer to paragraph 4-26, Gain Calibrate Control).

(10) Set the MARKERS switch to ON. Note that marker pips are displayed on the crt screen. If improper, replace tube V306 or crystal Y301 and/or associated defective circuitry.

(11) Turn MARKER GAIN control Maximum Clockwise. Note that marker pips are displayed on the crt screen. If improper, replace tube V306 or crystal Y301 and/or associated defective circuitry.

Reference Symbol	Tube Type	Adjustment to be Made
V103	12AY7	None
V104	5879	Harmonic Balance control R119, refer to paragraph 4-25.
V105,V106	6BH6	Balance Phasing control C107, refer to paragraph 4-24.
V107	6AB4	Gain Calibrate control R201, refer to paragraph 4-26.
V201,V202	6AB4	None
V203,V204,V205	12AU6	None (In some cases a slight peaking of the associated i-f transformer coil may be required.)
V206	6C4	DB Shape control R241 and DB Range control R243, refer to paragraph 4-23.
V301	12AU7	Rate control R301, refer to paragraph 4-21. Sweep circuit alignment, refer to paragraph 4-30. Line Size control R322 and Hor. Pos. control R327, to paragraph 4-10.
V302	6072	Sweep circuit alignment, refer to paragraph 4-30.
V303	85A2/5651	ZERO FREQ. CALIB. control, refer to paragraph 2-9.
V304	12AX7	Line Size control R322 and Hor. Pos. control R327, refer to paragraph 2-10.
V305	12AX7	Vert. Pos. control R337, refer to paragraph 2-10.
V306	6AB4	None
V401	6201	Local Oscillator alignment, refer to paragraph 4-31.

Table 4-5. Tube Replacement Adjustment Procedure (Sheet 1 of 2)

Reference Symbol	Tube Type	Adjustment to be Made
V401	6201	Local Oscillator alignment, refer to
V402	12AT7	None
V403	6AB4	None
V505	6AS7G	B+ Adjust control R510, refer to paragraph 4-20.
V506	12AU6	B+ Adjust control R510, refer to paragraph 4-20.
V508	0B2	None
V521	5ADP7	Presentation controls, refer to paragraph 2-10.

Table 4-5. Tube Reaplcement Adjustment Procedure (Sheet 2 of 2)

4-16. ADJUSTMENT AND ALIGNMENT INSTRUCTIONS

4-17. The following paragraphs detail the procedure for adjusting various internal controls which may be required due to replacement of components or aging of tubes. Instructions are also provided for alignment of the i-f circuit, and local oscillator. Refer to tables 4-2 through 4-5 to determine the applicable adjustment or alignment procedure required to bring the Model SS-500 to satisfactory operating condition. Allow at least 30 minutes of warm-up time for the equipment to stabilize before performing any adjustment or alignment procedure.

4-18. ADJUSTMENTS

4-19. FILAMENT ADJUST R516. Connect a multimeter between test point J503 and chassis. Adjust potentiometer R516 until meter indicates exactly .07 volts dc.

4-20. B+ ADJUST R510. Connect a multimeter between test point J504 and chassis. Adjust potentiometer R510 until meter indicates exactly +270 volts dc.

4-21. RATE CONTROL R301. The sweep trace on the cathode ray tube is to be adjusted for 3 sweeps per second. Follow the procedure below to adjust this control.

(1) Connect the vertical input of an oscilloscope to the sync output jack J302.

(2) Adjust R301 until the signal display (sawtooth) on the oscilloscope has a period of 333 milliseconds.

(3) When adjusting R301, readjustment of line size control (R322) and horizontal positioning control (R327) may be required. (Refer to paragraph 2-10.)

4-22. GAIN COMPENSATE CONTROL R225. This control is to be adjusted to maintain amplitude flatness of a signal pip as the deviation kc/s is varied from 1 to 100.

4-23. DB SHAPE CONTROL R241 AND DB RANGE CONTROL R243. These controls are used to set the log shaping circuit for proper logarithmic display on the crt. Follow the procedure below to perform this adjustment.

(1) Set the front panel controls to:

SCALE MULTIPLIER	- X0.25
ATTENUATOR	- X1K
GAIN	- Fully Clockwise
SCALE	- RMS
DEVIATION KC/S	- Minimum
CENTER FREQUENCY	- 50

(2) Apply a 50-kc signal to the equipment. Adjust the 50-kc signal level for a full-scale deflection on the crt.

(3) Set SCALE to DB. Set ATTENUATOR switch to X100.

(4) If the signal pip is not directly at the +20 DB screen indication, adjust DB range control R243 until signal pip is directly at the +20 DB screen indication.

(5) Set ATTENUATOR control to X1K.

(6) Adjust DB Shape control R241 until the signal pip is at the 0 DB screen indication.

(7) DB Range control R243 and Shape control R241 may require severla back-and-forth adjustments before the signal accurately follows the scale calibrations.

4-24. BALANCE PHASING CONTROL C107. If, after sufficient warm-up time, the zero-frequency pip cannot be reduced to at least one-quarter full screen deflection with front panel controls set to: SCALE MULTIPLIER - XO.25; DEVIATION KC/S - adjust control C107 as follows:

(1) Adjust BALANCE controls for maximum suppression of zero-frequency pip. (Refer to paragraph 2-12)

(2) Adjust control C107 for further eduction of zero-frequency pip to at least one-quarter full scale with controls set as above.

(3) Repeat steps 1 and 2 several times.

4-25. HARMONIC BALANCE CONTROL R119. This control is sued to insure at least 60 db of harmonic rejection. To adjust this control, proceed as follows:

(1) Set front panel controls to:

CENTER FREQUENCY	- 20
DEVIATION KC/S	- Maximum
VIDEO FILTER	- Off
SCALE	- RMS
ATTENUATOR	- X10
SCALE MULTIPLIER	- X25

(2) Apply a 20-kc signal to the INPUT/GND terminals of the equipment.

(3) Adjust 20-kc signal for full-scale deflection on CRT.

(4) Set SCALE switch to DB, SCALE MULTIPLIER control to XO.25

(5) If the 40-kc harmonic signal pip is below the -20 DB marking on the right side of the CRT screen, adjustment of R119 need not be required. If the harmonic signal pip is above the -20 DB marking, adjust R119 for minimum signal amplitude of harmonic signal. Relock R119.

(6) The above procedure assumes the input signal has 0.1% or less distortion.

4-20. GAIN CALIBRATE CONTROL R201. This control is used to calibrate the cathode ray tube screen for voltage measurements. To adjust this control, proceed as follows:

(1) Set front panel controls to:

DEVIATION KC/S	-	50
CENTER FREQUENCY	-	100
ATTENUATOR	-	X1
GAIN	-	Fully clockwise
SCALE MULTIPLIER	-	X0.25
SCALE	-	RMS
VIDEO FILTER	-	OFF

(2) Apply a 100-kc, 250 microvolt signal (calibrated) to the equipment.

(3) Adjust control R201 to give a full scale signal deflection on cathode ray tube screen. If unable to adjust to full scale deflection, proceed to I-F alignment procedures.

4-27. ALIGNMENT PROCEDURES

4-28. I-F Circuit. The following procedure is given for aligning the i-f circuit.

(1) Set the front panel controls to:

CENTER FREQUENCY	-	100
GAIN	-	Fully clockwise
DEVIATION KC/S	-	Maximum
SCALE	-	RMS
ATTENUATOR	-	X1
SCALE MULTIPLIER	-	X0.25
VIDEO FILTER	-	Off

(2) Remove the unit from the cabinet. Remove the bottom plate and i-f bottom plate.

(3) Adjust the Gain Calibration Control R201 to its mid-range.

(4) Apply a 1.5 mc signal (calibrated) through a 0.01 capacitor to pin 1 of tube V205. Adjust the 1.5 mc signal level until the baseline on the CRT is about halfway up on the screen.

NOTE

Use the 0.01 capacitor on all remaining steps.

(5) Adjust the i-f transformer Z203 for maximum vertical deflection of baseline. The level of the applied 1.5 mc signal should be approximately 70 millivolts. Remove the signal.

(6) Apply the 1.5 mc signal to pin 1 of tube V204. Adjust i-f transformer Z202 for maximum vertical deflection of the baseline. The level of the applied 1.5 mc signal should be approximately 5 millivolts. Remove the signal.

(7) Apply the 1.5 mc signal to pin 1 of tube V203. Adjust i-f transformer Z201 for maximum vertical deflection of the baseline. The level of the applied 1.5 mc signal should be approximately 40 uvolts. Remove the signal.

(8) Apply the 1.5 mc signal to pin 6 of tube V202. Adjust slightly the frequency of the 1.5 mc signal for maximum vertical rise of baseline. Adjust the level of the 1.5 mc signal for maximum vertical deflection of the baseline. The level of this signal should be approximately 60 uvolts. Remove the signal.

(9) Apply the 1.5 mc signal to pin 6 of tube V201. Adjust slightly the frequency of the 1.5 mc signal for maximum vertical rise of baseline. Adjust the level of the 1.5 mc signal for maximum deflection of the baseline. The level of the applied 1.5 mc signal should be approximately 70 uvolts. Z201, Z202, and Z203 should now be adjusted for maximum output.

(10) Apply the 1.5 mc signal to pin 6 of tube V107. Adjust Gain Calibration control R201 for maximum vertical deflection of the baseline. The level of the applied 1.5 mc signal should be approximately 20 uvolts. Remove the signal.

(11) Apply the 1.5 mc signal to pin 1 of tube V105. Adjust transformer Z102 for maximum vertical deflection of the baseline. Apply the 1.5 mc signal to pin 1 of tube V106. Adjust transformer Z102 for maximum vertical deflection of the baseline. Apply the 1.5 mc signal a few times to pin 1 of tubes V105 and V106 and adjust transformer Z102 for maximum vertical deflection of the baseline. The level of the applied 1.5 mc signal should be approximately 15 uvolts. Remove the signal.

(12) Connect an oscilloscope to pin 7 of tube V106. Note the frequency displayed is sweeping around 1.6 mc at an amplitude of .8 volts. Disconnect the oscilloscope.

(13) Apply a 100-kc, 15 uvolt signal to pin 1 of tube V104. Note a full-scale signal pip is directly at the center of the screen.

(14) Apply a 100-kc, 250 microvolt signal to the INPUT/GND terminals. Note a full-scale signal pip is directly at the center of the screen. If required, adjust Gain Calibrate Control R201 for full-scale signal pip.

4-29. CRYSTAL DRIVEN FILTER AMPLIFIERS V201 AND V202. Alignment of this circuit should only be performed after replacement of crystals Y201 or Y202. To align this circuit proceed as follows:

(1) Set front panel controls to:

CENTER FREQUENCY	- 100
VIDEO FILTER	- OFF
DEVIATION KC/S	- Maximum
SCALE	- RMS
ATTENUATOR	- X10
SCALE MULTIPLIER	- X2.5

(2) Remove the unit from the cabinet. Remove the bottom plate and i-f bottom plate.

(3) Apply a 100-kc signal to the INPUT/GND terminals. Adjust the signal level for full-scale deflection of the signal pip. Adjust the CENTER FREQUENCY control until the signal is directly at the center of the screen.

(4) Remove crystal Y201. Short-out crystal socket Y201 by connecting a clip lead between socket pins of removed crystal Y201.

(5) Adjust crystal trimmer C208 for minimum signal amplitude on screen.

(6) Set DEVIATION KC/S control to 1.

(7) Adjust input level of 100-kc signal for full-scale deflection of signal pip on screen. Set ATTENUATOR to X1. and SCALE to DB.

(8) Adjust neutralizing capacitor C206 to obtain signal pip as shown in figure 4-2.

(9) Remove clip lead and re-insert crystal Y201. Remove crystal Y202 and insert clip between socket pins of removed crystal Y202.

(10) Set DEVIATION KC/S control to maximum, ATTENUATOR to X10 and SCALE to RMS.

(11) Adjust applied signal level of 100 kc signal for full-scale deflection.

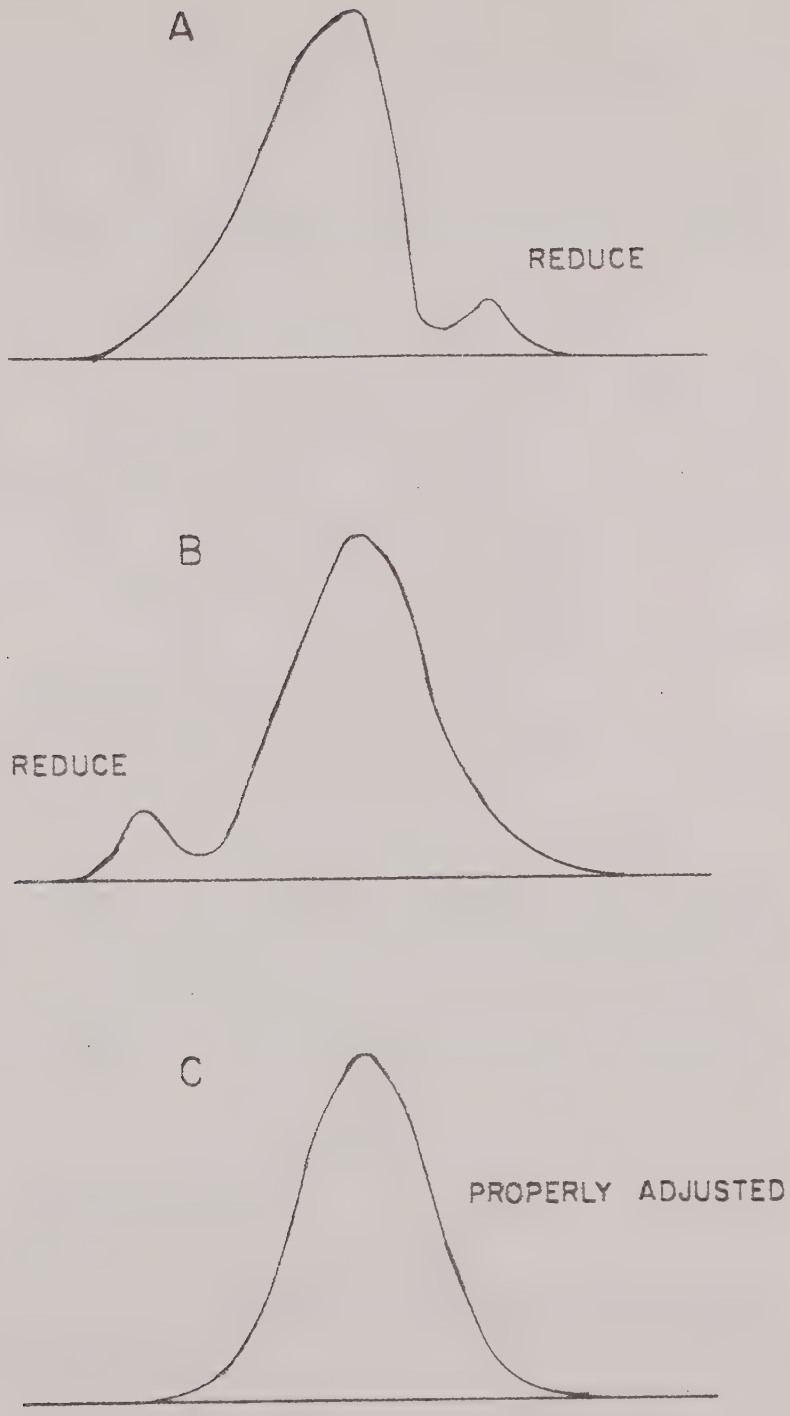


FIGURE 4-2
CRYSTAL FILTER AMPLIFER RESPONSE

(12) Adjust crystal trimmer C204 for minimum signal amplitude on screen.

(13) Set DEVIATION KC/S control to 1.

(14) Adjust input level of 100-kc signal for full-scale deflection. Set ATTENUATOR to X1 and SCALE to DB.

(15) Adjust neutralizing capacitor C202 to obtain signal pip as shown in figure 4-2.

(16) Remove clip lead and re-insert crystal Y202.

(17) Set DEVIATION KC/S control to 25, ATTENUATOR to X10 and SCALE to RMS.

(18) Adjust input signal level for full-scale deflection.

(19) Set DEVIATION KC/S control to 50.

(20) Adjust Gain Compensate control R225 for full-scale signal deflection.

(21) Repeat steps (19) and (20) until no interaction between controls is observed.

(22) Set DEVIATION KC/S control to minimum.

(23) Rotate DEVIATION KC/S control from minimum to maximum and note that signal pip amplitude does not vary more than 2 divisions. If improper, repeat steps 17 through 22 until proper repsone is obtained.

4-30. SWEEP CIRCUIT. To align the sweep circuit V301 and V302 proceed as follows:

(1) Set front panel controls to:

CENTER FREQUENCY	- 0
DEVIATION KC/S	- 1
SCALE	- RMS

(2) Adjust the CENTER FREQUENCY control slightly such that the zero frequency pip appears under the 0 deviation point on the CRT graticule.

(3) Set the DEVIATION control to 100. Adjust the S.W. Bal. control (R308) to return the zero frequency pip to the 0 deviation point on the CRT graticule.

(4) Repeat steps (2) and (3) until the zero frequency pip remains under the 0 deviation point on the CRT graticule as the deviation control is varied from 1 to 100.

(5) Apply a 100-kc signal (calibrated) to the INPUT/GND terminals.

(6) Adjust sweep width maximum control, R305, until the 100 kc signal pips are directly in line with the 100% deviation lines on both sides of the CRT graticule, and the zero-frequency pip is directly in line with the 0 deviation marking on the CRT graticule.

(7) Set the DEVIATION KC/S control to 1.

(8) Apply a 1 kc signal (calibrated) to the INPUT/GND terminals.

(9) Adjust minimum sweep width control, R313, until the 1 kc signal pips are directly in line with the 100% deviation lines on both sides of the CRT graticule.

4-31. LOCAL OSCILLATOR V401. To align the local oscillator, proceed as follows:

(1) Set front panel controls to:

CENTER FREQUENCY	- 0
DEVIATION KC/S	- 50
SCALE	- RMS
VIDEO FILTER	- OFF
ATTENUATOR	- X1
SCALE MULTIPLIER	- X2.5
ZERO FREQ. CAL.	- Mid-range

(2) Note the zero-frequency pip is directly over the center graticule of the screen. (Rotate the DEVIATION KC/S control towards 1, and adjust the GM Comp. control R405) to maintain signal in middle of screen if the zero frequency pip shifts position.

(3) Set DEVIATION KC/S control to maximum.

(4) Set CENTER FREQUENCY control to 500.

(5) Apply a 500-kc signal (calibrated) to the INPUT/GND terminals.

(6) Note the 500-kc signal pip is approximately at the center of the screen.

(7) Rotate the DEVIATION KC/S control towards 1. To maintain the 500-kc signal pip at the center of the screen, adjust transformer Z401.

(8) The entire procedure may have to be repeated several times in order to optimize the local oscillator circuit adjustment.

NOTE

Do not adjust C402. This has been set at the factory for proper operation.

4-32. REMOVAL AND REPLACEMENT INSTRUCTIONS.

4-33. To remove the main chassis from the cabinet, remove the eight screws from the sides of the front panel and pull the chassis from the cabinet. Side brackets on the main chassis enable the equipment to be placed in any convenient position for ease of maintenance. The right side bracket has two spare fuses and an alignment tool (tuning wand). To obtain access to the i-f circuits remove the two bottom plates.

4-34. Maintenance of the local oscillator assembly is amde more convenient by removal from the main chassis. To remove the local oscillator assembly, remove the three screws from the side bracket and pull the assembly out of its plug-in socket. The parts in the local oscillator cirucit are temperature-compensated; therefor, it is recommended that replacement of the entire assembly be made rather than individual components (except tubes).

4-35. CATHODE RAY TUBE. To remove the cathode ray tube, proceed as follows:

(1) Remove the four screws from bezel, screen, and amber filter.

(2) Remove cathode ray tube socket and unscrew neck clamp screw.

(3) Push cathode ray tube as far back into the mu-metal shield as possible.

(4) When the cathode ray tube is clear of the rubber ring, remove the rubber ring and cathode ray tube.

(5) To reinstall a cathode ray tube, proceed as follows:

(6) Insert the cathode ray tube in the shield, pushing as far back as possible.

(7) Be sure anode connection is facing up.

(8) Replace rubber ring and then dust rubber ring with a fine talc powder to prevent the tube from sticking in the rubber ring.

(9) Push cathode ray tube forword by placing the plam of the hand on socket on end of tube and pushing forward with even pressure.

(10) Replace tube socket and attach anode connector.

(11) Turn on the equipment. If the trace does not line up parallel with the horizontal lines of the screen, push the tube back until it clears the rubber ring and turn tube until trace aligns with screen markings.

(12) Push tube back into rubber ring.

(13) Replace screen, filter and bezel.

4-36. EDGE LIGHTING LAMPS. To remove a defective lamp, proceed as follows:

(1) Remove bezel, filter and screen.

(2) Four edge lighting lamps are now visible.

(3) Push in, turn counterclockwise, and remove defective lamp.

(4) Push in new lamp and turn it clockwise until it locks.

(5) Replace screen, filter and bezel.

4-37. SCHEMATIC. (located in back of manual)

4-38. The schematic shows the entire circuit of the Model SS-500. This diagram should be used in conjunction with Section III to help the operator understand the operation of the equipment. Used in conjunction with this section, it facilitates signal tracing and continuity testing during maintenance.

4-39. VOLTAGE AND RESISTANCE CHARTS. (located in back of manual)

4-40. The voltage and resistance charts should be used in conjunction with the trouble shooting procedures to aid in locating defective component(s) in malfunctioning or inoperative circuits.

SECTION V

PARTS LIST

1. This parts list provides a listing of all replaceable parts required for normal maintenance of the equipment.

   The list contains the following information:

   a. Reference Symbol. This number identifies the part and also appears on the schematic and on any illustrations referencing this part.

   b. Description. This is a description of the part which includes voltage ratings, current ratings etc., where necessary.

   c. Manufacturer's Part Number. This column contains the part number assigned by the manufacturer.

   d. Manufacturer's Code. This column contains a letter code identifying the manufacturer of the part. The listing of the letter codes follows immediately after this Spare Parts List.

   e. Maintenance Quantity. This column contains the recommended maintenance quantity for each part, based on the number used, and a one-year requirement for the equipment operating eight hours a day throughout the year.

2. Order Information -

   When ordering parts from the factory, always include the following:

   a. Instrument model number and name.

   b. Serial number.

   c. Reference symbol.

   d. Manufacturer's part number, description, and code.

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R101	RES.,FIXED,CARBON DEPOSIT,150K 1% 2W	C2C	AA	1
R102	Same as R101			
R103	Same as R101			
R104	RES.,FIXED,CARBON DEPOSIT, 5K 1% 1W	C1C	AA	1
R105	RES.,FIXED,CARBON DEPOSIT, 500 Ohm 1% ½W	C½C	AA	1
R106	RES.,FIXED,CARBON DEPOSIT, 50 1% ½W	C½C	AA	1
R107	RES.,FIXED,CARBON DEPOSIT, 11 1% ½W	C½C	AA	1
C108	Same as R107			
R109	RES.,FIXED,COMP., 220K 10% 1W	RC32GF224K	AB	2
R110	RES.,FIXED,COMP., 1.2K 10% ½W	RC20GF122K	AB	1
R111	RES.,FIXED,COMP., 2.2M 10% ½W	RC20GF225K	AB	2
R112	RES.,FIXED,COMP., 4.7K 10% ½W	RC20GF472K	AB	1
R113	Same as R112			
R114	RES.,VAR.,CARBON, 50K 10% 2W	Type JU	AB	2
R115	RES.,FIXED,COMP., 5.1K 5% ½W	RC20GF512J	AB	1
R116	RES.,FIXED,COMP., 47K 10% 1W	RC32GF473K	AB	1
R117	RES.,FIXED,COMP., 22K 10% ½W	RC20GF223K	AB	1
R118	RES.,FIXED,COMP., 18K 10% ½W	RC20GF183K	AB	1
R119	RES.,VAR.,CARBON, 10K 10% 2W	Type JU	AB	1
R120	RES.,FIXED,COMP., 100K 10% ½W	RC20GF104K	AB	3
R121	Same as R117			
R122	RES.,FIXED,COMP., 15K 10% ½W	RC20GF153K	AB	1
R123	RES.,FIXED,COMP., 1M 10% ½W	RC20GF105K	AB	1
R124	Same as R120			
R125	Same as R111			

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R126	Same as R111			
R127	Same as R120			
R128	Same as R120			
R129	RES.,FIXED,COMP., 510 5% ½W	RC20GF511J	AB	1
R130	RES.,FIXED,COMP., 39K 10% ½W	RC20GF393K	AB	1
R131	Same as R130			
R132	RES.,VAR.,WW, 10-Turn 50K 5%	62JA-50K	AC	1
R133	Not Used			
R134	Not Used			
R135	Not Used			
R136	RES.,FIXED,COMP., 47K 10% ½W	RC20GF473K	AB	2
R137	RES.,FIXED,COMP., 3.3K 10% ½W	RC20GF332K	AB	1
E138	RES.,VAR.,CARBON, 25K 10% 2W	Type JU	AB	1
R139	RES.,FIXED,COMP., 56K 10% 1W	RC32GF563K	AB	1
R140	RES.,FIXED,COMP., 10K 10% ½W	RC20GF103K	AB	1
R141	RES.,FIXED,COMP., 8.2K 10% ½W	RC20GF822K	AB	1
R201	Same as R114			
R202	Same as R123			
R203	Not Used			
R204	Not Used			
R205	Not Used			
R206	Not Used			
R207	RES.,FIXED,COMP., 10K 10% 2W	RC42GF103K	AB	1
R208	RES.,FIXED,COMP., 200 5% ½W	RC20GF201J	AB	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R209	Same as R208			
R210	RES.,VAR.,CARBON, 100K 10% 2W Log	Type JA	AB	1
R211	RES.,FIXED,COMP., 560 10% ½W	RC20GF561K	AB	1
R212	RES.,FIXED,COMP., 12K 5% ½W	RC20GF123J	AB	1
R213	Same as R210			
R214	Same as R208			
R215	Same as R208			
R216	Same as R210			
R217	Same as R211			
R218	Same as R212			
R219	RES.,FIXED,COMP., 39 10% ½W	RC20GF390K	AB	1
R220	Same as R136			
R221	Not Used			
R222	RES.,FIXED,COMP., 2.2K 10% ½W	RC20GF222K	AB	1
R223	Not Used			
R224	Same as R219			
R225	Same as R138			
R226	Same as R210			
R227	Not Used			
R228	RES.,FIXED,COMP., 82K 10% 1W	RC32GF823K	AB	1
R229	Same as R139			
R230	Same as R222			
R231	Not Used			
R232	Same as R120			
R233	RES.,FIXED,COMP., 100 10% ½W	RC20GF101K	AB	1

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R234	RES.,FIXED,COMP., 56 10% ½W	RC20GF560K	AB	1
R235	Same as R116			
R236	RES.,FIXED,COMP., 5.6K 10% 1W	RC32GF562K	AB	1
R237	Same as R120			
R238	RES.,FIXED,COMP., 150 10% ½W	RC20GF151K	AB	1
R239	RES.,FIXED,COMP., 15K 10% 1W	RC32GF153K	AB	1
R240	RES.,FIXED,COMP., 33K 10% 1W	RC32GF333K	AB	1
R241	Same as R114			
R242	RES.,FIXED,COMP., 68K 10% ½W	RC20GF683K	AB	1
R243	RES.,VAR.,CARBON, 250K 10% 2W	Type JU	AB	1
R244	RES.,FIXED,COMP., 150K 10% ½W	RC20GF154K	AB	1
R245	RES.,FIXED,COMP., 56K 10% ½W	RC20GF563K	AB	1
R246	RES.,FIXED,COMP., 220K 10% ½W	RC20GF224K	AB	2
R316	Same as R138			
R317	Same as R244			
R318	Same as R132			
R319	RES,FIXED, CARBON DEPOSIT, 10K 1% ½W	C½C	AA	1
R321	Same as R120			
R322	RES.,VAR.,CARBON, 500K 10% 2W	Type JU	AB	1
R323	Same as R242			
R324	Same as R120			
R325	Same as R120			
R326	Same as R109			
R327	RES.,VAR.,CARBON, 5K 10% 2W	Type JU	AB	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R328	Same as R137			
R329	RES.,FIXED,COMP., 27K 10% ½W	RC20GF273K	AB	1
R330	Same as R329			
R331	Same as R120			
R332	Same as R120			
R333	Same as R120			
R334	Same as R120			
R335	Same as R120			
R336	Same as R120			
R337	Same as R114			
R338	Same as R109			
R339	Same as R120			
R340	Same as R136			
R341	Same as R322			
R342	RES.,FIXED,COMP., 560 10% ½W	RC20GF564K	AB	1
R343	Same as R342			
R344	Same as R111			
R345	Same as R122			
R346	Same as R140			
R401	RES.,FIXED,COMP., 470K 10% ½W	RC20GF474K	AB	1
R402	RES.,FIXED,COMP., 220 10% ½W	RC20GF221K	AB	1
R403	RES.,FIXED,COMP., 2.4K 10% ½W	RC32GF242K	AB	1
R404	Factory Adjust			

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R405	Same as R327			
R406	Same as R136			
R407	RES.,FIXED,WW, 20K 20% 10W	1765	AD	1
R408	RES.,FIXED,COMP., 100K 10% 1W	RC32GF104K	AB	1
R409	RES.,FIXED,CARBON DEPOSIT, 1M 1% ½W	C½C	AA	1
R410	Same as R239			
R411	Same as R401			
R412	Same as R240			
R413	Same as R342			
R414	Same as R211			
R415	Same as R302			
R416	Same as R240			
R417	Same as R208			
R418	RES.,FIXED,COMP., 24K 10% 2W	RC42GF243K	AB	1
R419	RES.,FIXED,WW, 25K 20% 10W	1767	AD	1
R501	RES.,FIXED,COMP., 100K 10% 2W	RC42GF104K	AB	1
R502	RES.,FIXED,COMP., 4.7M 10% 2W	RC42GF475K	AB	1
R503	RES.,FIXED,COMP., 680K 10% 2W	RC42GF684K	AB	1
R504	RES.,FIXED,COMP., 5.6M 5% ½W	RC20GF565K	AB	1
R505	Same as R233			
R506	Same as R233			
R507	RES.,FIXED,COMP., 68 10% 1W	RC20GF680K	AB	1
R508	RES.,FIXED,COMP., 91K 5% ½W	RC20GF913J	AB	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R509	RES.,FIXED,COMP., 180K 10% 2W	RC42GF184K	AB	1
R510	Same as R114			
R511	RES.,FIXED,COMP., 82K 10% ½W	RC20GF823K	AB	1
R512	Same as R137			
R513	RES.,FIXED,COMP., 1.5K 10% 2W	RC42GF152K	AB	1
R514	RES.,FIXED,WW, 12K 10% 5W	Koolohm	AE	1
R515	Same as R514			
R516	RES.,VAR.,WW, 100 25W	0151	AD	1
R517	Same as R114			
R518	Same as R109			
R519	Same as R122			
R520	Same as R243			
R521	Same as R503			
R522	Same as R322			
R523	Same as R246			
R524	Same as R246			
R525	Same as R246			
R526	Same as R246			
R527	Same as R246			
R528	RES.,VAR.,CARBON, 50 10% 2W	Type JUS	AB	1
R529	Same as R246			
R530	Same as R123			
R531	RES.,FIXED,WW, 82 3W	450E8205	AE	1
R532	RES.,FIXED,COMP., 470K 10% 1W	RC32GF474K	AB	1
R533	RES.,FIXED,COMP., 47 10% ½W	RC20GF470K	AB	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
R534	Same as R533			
R535	Same as R502			
R600	RES.,FIXED, CARBON DEPOSIT, 1.8M 1% ½W	C½C	AA	1
R601	Same as R600			
R602	Not Used			
R603	Factory Adjust			
C101	CAP.,TRIMMER,CERAMIC 7-45UUF	503-33R	AF	2
C102	CAP.,FIXED,CERAMIC DISK, .02UF GMV 500V	1D203	AK	3
C103	CAP.,FIXED,SIL MICA, 47UUF 5% 500V	CM15E470J	AJ	2
C104	CAP.,FIXED,PAPER, .1UF 400V	10YE104K	AH	2
C105A C105B C105C	CAP.,FIXED,ELECT., 80UF 450V 40UF 450V 20UF 450V	TMT 3763	AH	1
C106	Factory Adjust			
C107	CAP.,PISTON, CERAMIC, 3-25UUF	CS6-50	AI	1
C108	Same as C104			
C109	Same as C104			
C110	Not Used			
C111	Same as C104			
C112	Same as C104			

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
C113A C113B	CAP.,FIXED,ELECT., 20UF 450V 20UF 450V	TMD 2625	AH	1
C114	CAP.,FIXED,SIL MICA, 240UUF 5% 500V	CM15E240J	AJ	1
C115	Same as C114			
C116	CAP.,FIXED,SIL MICA, 100UF 5% 500V	CM15E101J	AJ	2
C117	Same as C102			
C118	Not Used			
C119	Same as C102			
C120	Same as C102			
C121	Factory Adjust			
C122	Same as C101			
C123	Same as C101			
C124	Same as C103			
C125	Same as C103			
C126	Same as C103			
C127	Same as C101			
C201	Same as C102			
C202	CAP.,TRIMMER,CERAMIC, 1.5-7UUF	503-10R	AF	1
C203	Same as C102			
C204	Not Used			
C205	Same as C102			
C206	Same as C202			
C207	Same as C102			
C208				
C209	Same as C102			

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
C210	Same as C102			
C211	Same as C102			
C212	Same as C116			
C213	Same as C116			
C214	Same as C102			
C215	Same as C102			
C216	Same as C102			
C217	Same as C116			
C218	Same as C116			
C219	CAP.,FIXED,SIL MICA, 130UUF 5% 500V	CM15E131J	AJ	1
C220	Same as C102			
C221	CAP.,FIXED,CERAMIC DISK, .01UF GMV 600V	DD6-103	AK	1
C222	Same as C113			
C223	Same as C102			
C224	Same as C116			
C225	Same as C116			
C226	Same as C102			
C227	Same as C219			
C228	CAP.,FIXED, SIL MICA, 430UUF 5% 300V	CM15E430J	AJ	1
C229	Not Used			
C230	CAP.,TRIMMER,DUAL, 7.45UUF	519 33R	AF	1
C231	Part of C230			
C232	CAP.,FIXED,SIL MICA, 160UUF 5% 500V	CM15E161J	AJ	2
C233	Same as C228			
C234	CAP.,FIXED,SIL MICA, 470UUF 5% 300V	CM15E431J	AJ	2
C235	CAP.,FIXED,SIL MICA, 1000UUF 5% 500V	CM20E102J	AJ	2

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY
C236	CAP.,FIXED, SIL MICA, 2200UUF 5% 500V	CM20E222J	AJ	1
C237	CAP.,FIXED,SIL MICA, 27UUF 5% 500V	CM15E270J	AJ	1
C238	Same as C237			
C239	Same as C232			
C240	Same as C232			
C241	Same as C232			
C242	Not Used			
C243	Not Used			
C244	Not Used			
C245	CAP.,FIXED,SIL MICA, 20UUF 5% 500V	CM15C200J	AJ	1
C246	CAP.,FIXED,SIL MICA, 51UUF 5% 500V	CM15E510J	AJ	1
C247	Same as C234			
C248	CAP.,FIXED,SIL MICA, 560UUF 5% 500V	CM20E561J	AJ	1
C249	CAP.,FIXED,SIL MICA, 150UUF 5% 500V	CM20E151J	AJ	1
C301	CAP.,FIXED,MYLAR, .33UF 20% 100V	600UE33401W2	AG	1
C302	CAP.,FIXED,MYLAR, .68UF 10% 400V	614G68494W1	AG	1
C303	Not Used			
C304	Same as C235			
C305	CAP.,FIXED,CERAMIC DISK, .0039UF GMV 500V	1D-.0039	AK	1
C306	Same as C102			
C307	Same as C104			
C308	Same as C305			
C309	CAP.,FIXED,SIL MICA, 1200UUF 5% 500V	CM20E122J	AJ	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT QTY.
C310	Same as C234			
C311	Same as C232			
C312	Same as C104			
C313	CAP.,FIXED,SIL MICA, 18UUF 5% 500V	CM15C180J	AJ	1
C314	Same as C313			
C315	Same as C234			
C401	Same as C101			
C402	CAP.,FIXED,MYLAR, .47UF 20% 100V	600EU47401W2	AG	1
C403	CAP.,FIXED,SIL MICA, 27UUF 5% 500V	CM15E270J	AJ	1
C404	CAP.,FIXED,MICA, .01 10% 300V	CM30B105K	AJ	1
C405	Same as C113			
C406	Same as C404			
C407	Same as C248			
C408	Same as C235			
C409	Same as C114			
C410	CAP.,FIXED,MYLAR, .047UF 20% 400V	600UE47304W2	AC	1
C411	CAP.,FIXED,SIL MICA, 820UUF 5% 500V	CM20E821J	AJ	1
C412	Same as C102			
C413	Same as C116			
C501A C501B	CAP.,FIXED,OIL .25UF 2000V .25UF 2000V	AOCDM23	AM	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT QTY.
C502	Same as C501			
C503	CAP.,FIXED,ELECT., 20UF 450V	FP 144	AY	1
C504	CAP.,FIXED,ELECT., 16UF 600V	MC16-600	AH	1
C505	Same as C504			
C506	CAP.,FIXED,MYLAR, 2UF 20% 400V	663UW20504W2	AG	1
C507	CAP.,FIXED,ELECT., 10UF 450V	9275S2	AH	1
C508	Same as C503			
C509A C509B	CAP.,FIXED,ELECT., 150UF 250V 150UF 250V	927165L	AH	1
C510	Same as C509			
C511	Same as C104			
L101	INDUCTOR,FIXED, 120UF	2890-44	AN	2
L102	Same as L101			
L103	Same as L101			
L201	INDUCTOR,VAR., 130-205UH	1214	AZ	1
L202	Same as L202			
L203	INDUCTOR,FIXED, 10MH	3500-42	AN	1
L301	Same as L203			
L401	Same as L203			
L402	Same as L101			
L501	INDUCTOR,FIXED, 12H	B281	AO	1

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
Z101	INPUT FILTER ASSEMBLY	A436	AO	1
Z102	MIXER COIL ASSEMBLY	A507	AO	1
Z201	1500KC IF COIL ASSEMBLY	A508	AO	1
Z202	1500KC IF COIL ASSEMBLY	A509	AO	1
Z203	1500KC IF COIL ASSEMBLY	A510	AO	1
Z401	OSC. COIL ASSEMBLY	A511	AO	1
T301	BLOCKING TRANSFORMER	A8122	AP	1
T501	LINE REG. TRANSFORMER	A1104	AO	1
T502	POWER TRANSFORMER	B283	AO	1
T503	FIL. TRANSFORMER 6.3V	B282	AO	1
Y201	CRYSTAL FILTER, 1500KC		AQ	2
Y202	Same as Y201			
Y301	100KC CRYSTAL OSC.		AQ	1
S101	SWITCH,ROTARY,SP5Pos.	1400	AK	1
S201	SWITCH,ROTARY, 1P7Pos.	2502	AK	1
S202	SWITCH,TOGGEL, DPDT	ST22N	AR	1
S301	SWITCH ROTARY SP4P	4M1114	AY	1
S302	SWITCH,ROTARY,2P2P	1402	AK	1
S501	Part of R528			

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY
V101	NEON LAMP	NE2	AS	2
V102	Not Used			
V103	TUBE,ELECTRON	12AY7	AT	1
V104	TUBE,ELECTRON	5879	AT	1
V105	TUBE,ELECTRON	6BH6	AT	2
V106	Same as V105			
V107	TUBE,ELECTRON	12AU6	AT	2
V201	TUBE,ELECTRON	6AB4	AT	2
V202	Same as V201			
V203	Same as V107			
V204	Same as V107			
V205	Same as V107			
V206	TUBE,ELECTRON	6C4	AT	1
V301	TUBE,ELECTRON	12AU7	AT	1
V302	TUBE,ELECTRON	6072	AT	1
V303	TUBE,ELECTRON	5651	AT	1
V304	TUBE,ELECTRON	12AX7	AT	2
V305	Same as V304			
V306	Same as V201			
V401	TUBE,ELECTRON	6201	AT	1
V402	TUBE,ELECTRON	12AT7	AT	1
V403	Same as V201			
V501	Not Used			

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
V502	Not Used			
V503	Not Used			
V504	Not Used			
V505	TUBE,ELECTRON	6AS7G	AT	1
V506	Same as V107			
V507	TUBE,ELECTRON	85A2/5651	AT	1
V508	TUBE,ELECTRON	0B2	AT	1
V509	Same as V101			
V510	Same as V101			
V511	Same as V101			
V512	Same as V101			
V513	Same as V101			
V514	Same as V101			
V515	PILOT LIGHT, 6.3V MIN BAY	NO. 47	AS	2
V516	Same as V515			
V517	Same as V515			
V518	Same as V515			
V519	Same as V515			
V520	Same as V515			
V521	CATHODE RAY TUBE	5ADP7	AV	1
CR501	Not Used			
CR502	RECTIFIER, HV, 1810 PIV	SS95HP	AV	1
CR503	Same as CR502			

PARTS LIST

REF. SYMBOL	DESCRIPTION	MANUFACTURER PART NUMBER	MFR'S CODE	MAINT. QTY.
CR504	DIODE,SILICON, 600 PIV. 350MA	SR3011	AW	1
CR505	Same as CR504			
CR506	Not Used			
CR507	Same as CR504			
CR508	Same as CR504			
CR509	Not Used			
CR510	Same as CR504			
CR511	Same as CR504			
CR512	Not Used			
CR513	Same as CR504			
CR514	Same as CR504			
CR515	Same as CR504			
CR516	Same as CR504			
F501	FUSE, 2 AMP	AGC	AX	2
F502	Same as F501			

MANUFACTURERS' LIST

AA	Kidco
AB	Allen-Bradley
AC	Clarostat
AD	Ohmite
AE	Sprague
AF	Erie Resistor Co.
AG	Good-All Mfg.
AH	General Instrument Co.
AI	Cambion
AJ	Arco
AK	Centralab
AL	Gudeman Mfg.
AM	Plasticon
AN	Delevan Mfg.
AO	Probescope Co., Inc.
AP	Stancor
AQ	Electronic Research Corp.
AR	JBT
AS	Dialight Company
AT	General Electric
AU	Thomas Electronics
AV	Semicon
AW	Sylvania Electric
AX	Bussman Mfg.
AY	Mallory Mfg.
AZ	Delta Mfg.

VOLTAGE AND RESISTANCE CHART, MODEL SS-500

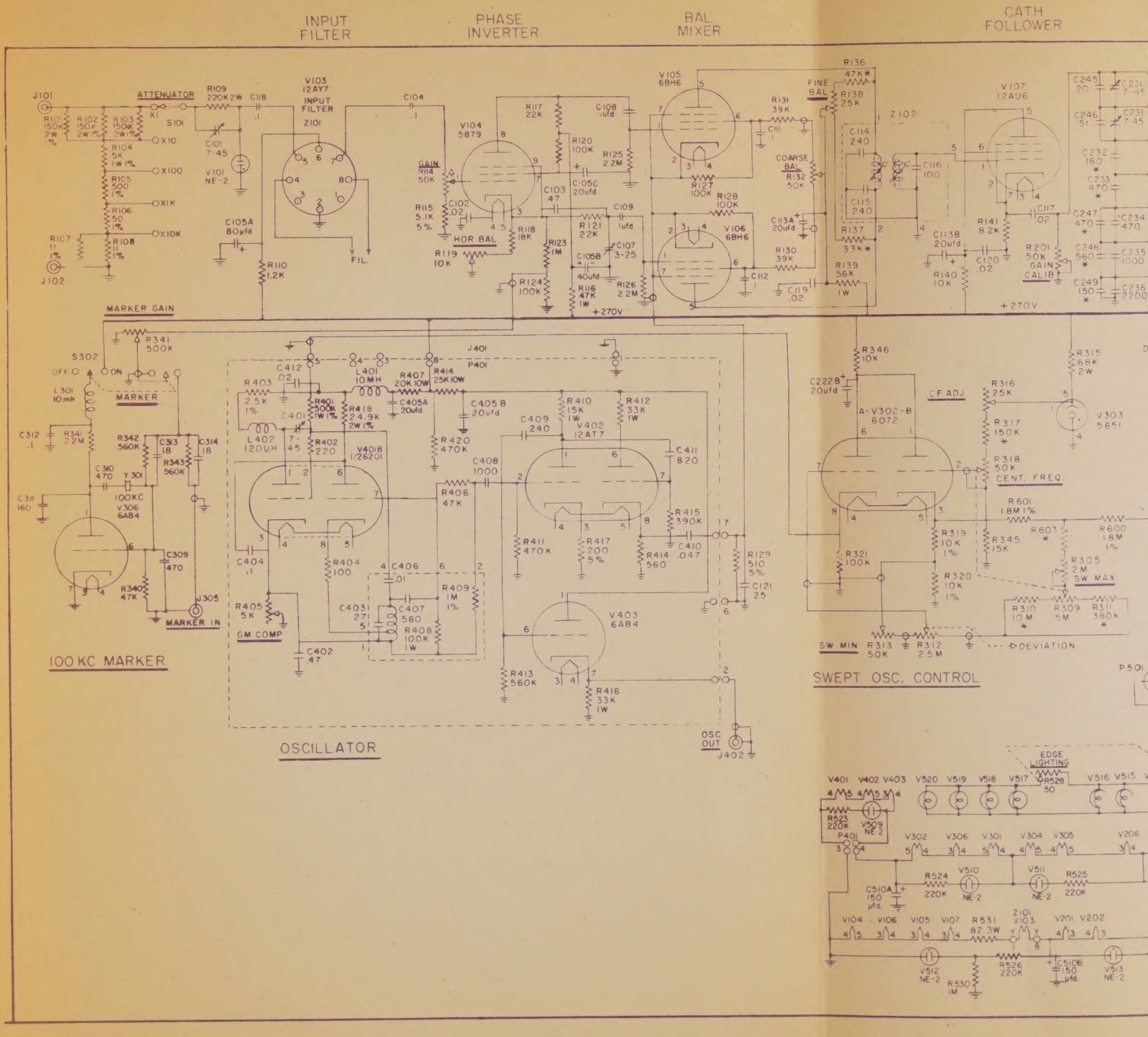
Controls Set As Follows:

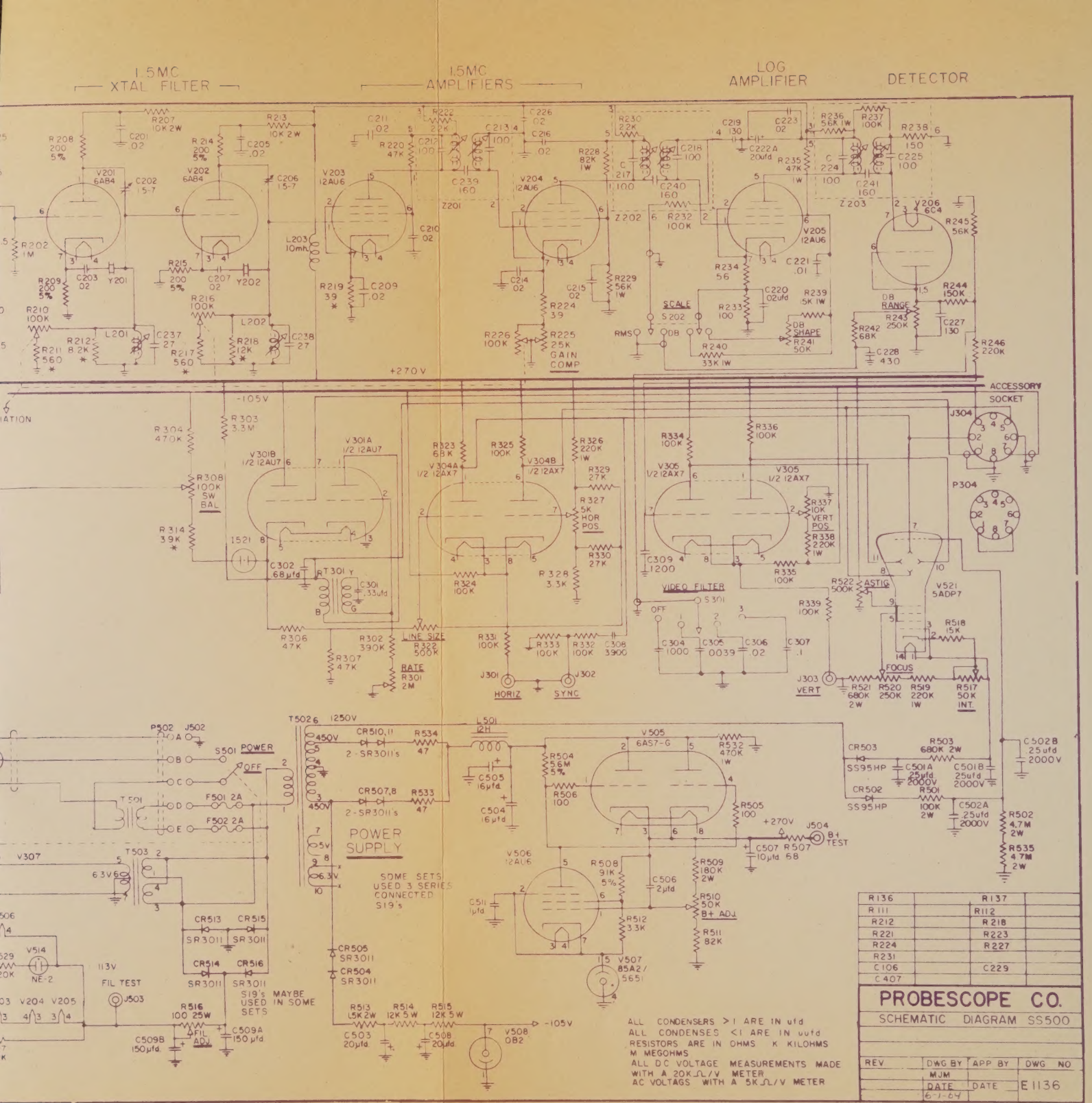
DEVIATION--100 KC
CENTER FREQ.--100KC
MARKERS--ON
VIDEO FILTER--Out
SCALE MULTIPLIER--10
SCALE--RMS
COARSE BALANCE--Mid-Range
FINE BALANCE--Mid-Range

	1	2	3	4	5	6	7	8	9
Z101	44 650hms	-0 -	- -	31 250hms	0 2 Meg	260 20K	4.6 4.8K	55 700hms	
V104	ODC 60K	- -	11 20K	ODC 00hms	7 160hms	- -	220 160K	220 80K	11 20K
V105	ODC 2 Meg	1.3 .5K	13 120hms	17 180hms	110 40K	60 50K	1.3 .5K		
V106	ODC 2 Meg	1.3 .5K	7 60hms	12 120hms	105 40K	65 50K	1.3 .5K		
V107	ODC 40hms	6.6 9K	31 260hms	18 160hms	260 25K	260 25K	6.6 9K		
V201	190 30K	- -	62 750hms	55 750hms	- -	ODC 1.1 Meg	1.5 2100hms		
V202	192 30K	- -	64 750hms	62 750hms	- -	ODC 7 0hms	1.4 2100hms		
V203	ODC 80hms	1.4 1700hms	80 750hms	68 750hms	248 20K	128 600hm	1.4 1700hms		

	1	2	3	4	5	6	7	8	9
V204	ODC 40hms	2.5 28K	80 72.50hm	92 750hms	 21K	 60K	2.5 28K		
V205	ODC 110K	1 2000hm	105 70.00hm	92 72.50hm	240 20K	130 30K	1 2000hm		
V206	-.6 to -1 120K	- -	85 6500hm	92 675 Ohm	ODC 120K	ODC 120K	ODC 1700hm		
V301	55 to 60 3.5 Meg	-2.8 1.1 Meg	oDC ODC	56 500hms	45 450hms	270 10K	60 to 65 3.5 Meg	80 to 85 60K	
V302	255 26K	15 35K	20 30K	42 2900hm	32 3200hm	255 26K	1.6 1.5 Meg	16 110K	
V303	80 50K	- -	- -	- -	80 60K	- -	ODC ODC		
V304	200 to 205 110K	5 110K	9 300K	56 500hms	70 600hms	210-215 110K	7 10K	9 300K	- NC
V305	230 100K	-.6 1.5K	1.7 320K	74 600hms	84 650hms	195 100K	-.05 270K	1.7 320K	- NC
V306	7.2 2.2 Meg	- -	42 400hms	48 440hms	- -	ODC 50K	ODC 0		
V401	185 20K	16 130K	20 4.8K	ODC 00hm	13 170hms	110 60K	16 100K	20 4.8K	
V402	90 50K	ODC 480K	.6 2000hm	13 120hms	25 270hms	80 70K	ODC 390K	6K	
V403	180 40K	- -	25 250hms	- 300hms	- -	ODC 5600hm	4.6 30K		
V505	210 5M	410 350K	270 14K	216 .5 Meg	410 350K	270 14K	3.2 AC ODC	3.2VAC	

	1	2	3	4	5	6	7	8	9
V506	85	85	95	107	210	90	85		
	35K	80K	50K	55	50 Meg	80K	80K		
V507	85	ODC	NC	NC	NC	NC	NC		
	80K	ODC	NC	NC	NC	NC	NC		
V508	ODC	-100	NC	-110	NC				
	ODC	200K	NC	200K	NC	NC	NC		


INPUT FILTER
PHASE INVERTER
BAL MIXER
CATH FOLLOWER
ATTENUATOR
INPUT FILTER
FINE BAL
COARSE BAL
HOR BAL
GAIN
MARKER GAIN
MARKER
GM COMP
CF ADJ
CENT. FREQ.
SW MAX
SW MIN
DEVIATION
EDGE LIGHTING
+270V
100 KC MARKER
OSCILLATOR
SWEPT OSC. CONTROL
J101
J102
J305
J401
J402
P401
P501
S101
S302
Y301
Z101
Z102
V101 NE-2
V103 12AY7
V104 5879
V105 6BH6
V106 6BH6
V107 12AU6
V301 6AB4
V302 12AT7
V303 5651
V306 6AB4
V401 V402 V403
V403 6AB4
V501 V502 V503
V504 V505 V506
V507 V508 V509 NE-2
V510 NE-2
V511 NE-2
V512 NE-2
V513 NE-2
V517 V518 V519 V520
V516 V515
V201 V202
V206
V302 V306 V301 V304 V305
V104 V106 V105 V107
R101 150K 2W
R102 150K 2W 1%
R103 150K 2W 1%
R104 5K 1W 1%
R105 500 1%
R106 50 1%
R107 11 1%
R108 11 1%
R109 220K 2W
R110 1.2K
R114 50K
R115 5.1K 5%
R116 47K 1W
R117 22K
R118 18K
R119 10K
R120 100K
R121 22K
R123 1M
R124 100K
R125 2.2M
R126 2.2M
R127 100K
R128 100K
R129 510 5%
R130 39K
R131 39K
R132 50K
R136 47K*
R137 33K*
R138 25K
R139 56K 1W
R140 10K
R141 8.2K
R201 50K GAIN CALIB
R310 10M *
R309 5M
R311 380K *
R312 2.5M
R313 50K
R315 68K 2W
R316 25K
R317 150K *
R318 50K
R319 10K 1%
R320 10K 1%
R321 100K
R341 500K
R342 560K
R343 560K
R340 47K
R345 15K
R346 10K
R401 500K 1W 1%
R402 220
R403 2.5K 1%
R404 100
R405 5K
R406 47K
R407 20K 10W
R408 100K 1W
R409 1M 1%
R410 15K 1W
R411 470K
R412 33K 1W
R413 560K
R414 560
R415 390K
R416 33K 1W
R418 24.9K 2W 1%
R420 470K
R523 220K
R524 220K
R525 220K
R526 220K
R530 1M
R531 82.3W
R601 1.8M 1%
R600 1.8M 1%
R603 *
C101 7-45
C102 .02
C103 47
C104 .1
C105A 80µfd
C105B 20ufd
C105C 20ufd
C107 3-25
C108 .1ufd
C109 1ufd
C110 40ufd
C111 1
C112 1
C113A 20ufd
C114 240
C115 240
C116 100
C117 .02
C118 .1
C119 .02
C120 .02
C121 25
C138 20ufd
C222B 20ufd
C232 160 *
C233 470 *
C234 470
C235 1000
C236 2200
C245 20
C246 51
C247 470 *
C248 560 *
C249 150 *
C231 7-45
C301 470
C309 470
C310 470
C311 160
C312 .1
C313 18
C314 18
C341 2.2M
C401 7-45
C402 .47
C403 271 5
C404 .1
C405A 20ufd
C405B 20ufd
C406 .01
C407 560
C408 1000
C409 240
C410 .047
C411 820
C412 .02
L301 10mh
L401 10 MH
L402 120UH
V401B 1/2620I
A-V302-B 6072
X1
X10
X100
X1K
X10K
FIL
OFF
ON
OSC OUT
MARKER IN



R136		R137	
R111		R112	
R212		R218	
R221		R223	
R224		R227	
R231			
C106		C229	
C407			

PROBESCOPE CO.

SCHEMATIC DIAGRAM SS500

REV	DWG BY	APP BY	DWG NO
	MJM		
	DATE 6-1-64	DATE	E1136